



Carbon Dioxide Nutrients Fans Lighting Electricity Reflectors
Timers PPM Hydroponics Schedules Pests and Prevention PH
Room Set Up Mildew Pythium Reservoirs Pumps Water Oxygen
Staking Temperature Cloning Spider mites Grow Rocks Drying
Rockwool Packaging Flood Tables Flip Systems Blueprints Soil



Marijuana Mass Production Made Easy

Average 2lbs of Bud or more
per 1000W light.

Blueprints and secrets to success
fully explained.

British Columbia
Hydroponic Growers Guide

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VISIT...

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The reference to mass production in the title of our book only refers to achieving the maximum yield per given space large or small. Our title is not meant to encourage anyone to engage in illegal activities.

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INTRO

This book contains over 20 years experience in the cultivation of hydroponic indoor marijuana with valuable tips and advice that will not be found in any other publication. The information contained here will show you exactly how and why you will achieve professional results with a minimum of 2 lbs + of dried marijuana per 1000w light.

Included are illustrations and step by step instructions on how to set up, operate and cultivate marijuana indoors for small scale operation to mass production. We show you how it is possible for 1 person to maintain all aspects of a large operation (100-1000 Plants or more) with careful planning and crop management .

Also included in this book is a blueprint for building and operating a 1000sq ft grow-op that will produce 200lbs of dried marijuana in 12 months (12 lbs every 3 weeks).

The author of this book has developed a simple system that even a beginner can easily understand, as well many professionals will appreciate solutions to everyday problems. We don't just say that our method is superior, we explain the difference between our system and other systems available today.

By following our directions you will be able to avoid simple mistakes that can cause catastrophic failure. All the rooms we have ever built are filled to 95% capacity leaving only a minimal amount of space to enter and maintain. This truly is the way to ensure a maximum yield.

In addition we provide instructions on how to make your own hydroponic nutrient solution that has been developed especially for indoor marijuana cultivation. Our hydroponic food costs a fraction of what you will pay for brand name foods available off the shelf. On average we create 100 gallons of hydroponic solution for less than \$2.00. When you consider that large scale operations consume an average of 3000-4000 gallons of nutrient per month it is necessary to find a quality alternative to brand name hydroponic foods. All the photos in this book and on our website are actual photos of grow rooms we designed using the methods provided in our book.

For best results we suggest you follow the instructions exactly, using different lighting, changing the amount or size of plants will affect the yield and harvest dates. Every detail in our book such as temp, CO2 application, spacing, lighting, reflectors has been proven to work and will result in heavy harvests of 2 lbs or more per 1000w light.



HYDROPONICS

Hydroponics is defined as growing plants without soil. Rockwool is the medium used in hydroponics because it retains moisture and has no organic matter in it. Rockwool is in fact fiber spun from rock in order to make wool. Its appearance is very similar to fiberglass. The difference between fiberglass and Rockwool is that Rockwool absorbs moisture and fiberglass does not. Rockwool is more user friendly than fiberglass and will not make your skin itch.

In a hydroponic system nutrient is delivered from a water pump to the plant container through a series of plastic tubing. The tubing is inserted into the top of the plant container where it feeds nutrient to the plant several times per day. Nutrient can not build up in a container filled with Rockwool because the container is being flushed through as it is being fed. Hydroponic systems can be designed for use on flood tables or may also be designed in grow tubes much like aeroponics.

Hydroponic systems all have this in common. The system is automated with a water pump and timer. The plants are fed many times per day. The nutrient returns back to a reservoir. The advantages to hydroponics are that the plants are grown in larger containers with more Rockwool than used in an aeroponics system. When properly designed hydroponic systems are low maintenance and only require that you check them every other day. In the event of a pump failure there should be enough Rockwool in a container for the plants to live up to 3 days before they die.



Actual photo



Actual photo

Hydroponic grow systems provide the maximum amount of nutrient to the plant several times per day. Plants can be fed every day and it is not necessary to alternate feedings with watering as associated with soil. Hydroponic systems provide much more oxygen to the roots than if you were to grow your plants in soil. It is very easy to monitor the exact amount of food and PH in a hydroponic grow system and make adjustments very quickly. Plants that are grown with hydroponics will produce more bud than if you grow in soil.



SOIL

Soil is the original medium for growing plants and can be found in your backyard or it may be purchased from your local hydroponic supplier. Growing marijuana in soil has some advantages as well as some disadvantages. Certain people who grow marijuana in soil like to because it can provide an organic flavor that is difficult to duplicate with hydroponics or aeroponics. Plants generally do not grow as fast or as big in a soil mixture as compared to hydroponics or aeroponics.

Quality soil contains more ingredients than just dirt. Good soil has a mixture of vermiculite, perlite and other organic matter such as peat. Without additives like perlite etc, dirt would turn to mud when water is added. The purpose of having vermiculite and perlite in your soil is to provide more air spaces which encourage root growth. When buying a soil mixture we recommend you purchase a quality premixed soil from your local hydroponic store.

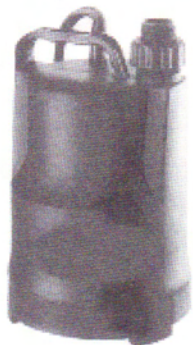
Soil serves a few purposes (a) keeps plants from falling over (b) holds moisture and nutrients in (c) provides a dark area for the roots to grow (roots do not grow in light)

When growing plants it is best to wait a few days between watering. You can actually kill a plant with over watering because the roots won't have access to oxygen. What happens between watering is that the soil dries out and the roots are forced to (grow) search for more water.

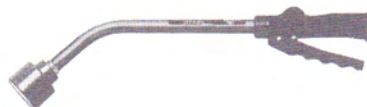
The bigger the root system grows on a plant the bigger the plant can grow. If you are not sure if it is time to water a plant in soil again then insert your finger into the top of the soil, feel down about 3 inches and if you feel moisture then wait another day before watering. Purchase a 1 part liquid Grow and Bloom formula from your hydroponics supplier for best results and Mix to 900 (PPM) Part Per Million.

Some people believe that soil must be thrown out and replaced after each use. This is not true, in fact if everything is done properly soil will last many years.

Feeding large soil crops indoors can be time consuming. A good idea is to connect a garden hose and watering wand to a water pump which sits in a large reservoir with nutrients. This makes it possible to walk through the crop and water each plant individually without bending over to pour water into each plant. When just watering you can connect the garden hose to your cold water tap.



Water Pump



Water Wand

Plants in soil require nutrients and food just like all other plants. There are not enough nutrients in soil to make a plant grow at a steady rate. However you can also kill a plant by providing it with too much nutrient or food. Early signs of over feeding a plant are when the leaves begin to turn yellow or brown, the tips die and break off. If the plants show signs of over feeding begin to use only water for approx the next 5 feedings to flush out the extra nutrients trapped in the soil.

Always alternate between feeding and watering. Also stop feeding your plants 2 weeks before harvesting (Water Only). Watering before harvest flushes out nutrients and makes the finished product (Marijuana Bud) burn better and taste better.

In an extreme situation where the plant is badly damaged from over feeding take the soil container to an area like a bathtub and run water over the top of the dirt with a garden hose until the excess water running out the bottom of the container is clear. This may take up to 30 minutes before the water starts to run clear.



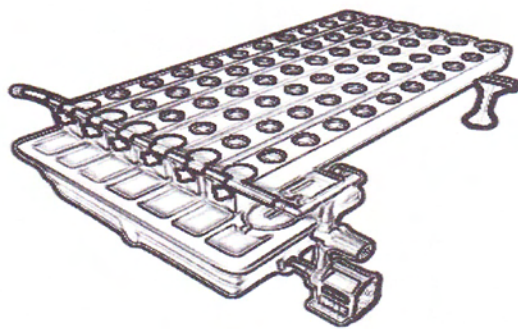
AEROPONICS

Aeroponics systems are slightly different than Hydroponics. Some advantages of aeroponics are that plants grow incredibly fast compared to all other methods of growing. This is because aeroponics use high pressure water pumps to mix the nutrients with oxygen which are delivered to the root system in a fine mist. It is a fact that more oxygen to the roots means faster growth.

Aeroponics systems make use of Rockwool as a medium and are designed with grow tubes with holes cut out for the plants containers to sit in. These systems work very well for an experienced grower who has time to monitor the grow room a few times per day. Aeroponics systems are best suited for maximum production in small areas.

The disadvantages of Aeroponics are that the system is very high maintenance. The parts of the system that create the mist of nutrient have very small openings for the nutrient to pass through. It is common for very small pieces of matter to clog the parts that create the mist. This means that you must visually check every part of the system every day.

It may take only a few hours for a plant to die without sufficient nutrient in an Aeroponics system. Most often this is because the plant containers in an Aeroponics system are very small and do not have enough reserve moisture to save a plant in the event of a clog or pump failure. Aeroponics systems feed the plants from inside the grow tubes. The nutrient goes directly to the roots and does not travel from the top of the plant container to the roots. As soon as the roots dry out the plant will die and need to be replaced.



Typical Aeroponics System



NUTRIENTS

Most hydroponic nutrients come in one of two types, growth formula or bud formula. The difference between growth and bloom is that the growth formula has the nutrient Potassium Nitrate (KNO_3). The bloom formula does not have KNO_3 and also has a higher concentration of Potash (K_2SO_4). There are many types of nutrients that plants require, here is a list of the most common..

CA NO_3	Calcium Nitrate
K_2SO_4	Potassium Sulphate
KH_2PO_4	Mono Potassium Phosphate
MG SO_4	Magnesium Sulphate
KNO_3	Potassium Nitrate
Trace Elements	Micro Nutrients

These nutrients are available in every food formulation and are essential for growth of all plants known to man. Every brand name food available in your local hydroponic store have the same nutrients with slight differences in levels depending on the application. It is recommended that if you purchase a container of premade hydroponic formula off the shelf that you vigorously shake the container to ensure all nutrients are available each time you make a mixture of food for your plants.

It is common for nutrients to settle to the bottom of the container they have been packaged in after a period of time. It also is a fact that sometimes the nutrients can bond together when they settle to the bottom of the container they are packaged in. If the nutrients bond together they become useless as the plants will not be able to absorb the nutrients as they were meant to be suspended in a liquid solution. When nutrients bond together this is called flocculation.

Sometimes people will purchase a very large container of hydroponic formula such as 30 gallon container. It sounds like a wise idea to buy in bulk as it is cheaper, however large containers of hydroponic formula usually sit for long periods of time and are very difficult to shake prior to use. Most often a year later when you get to the bottom of the container you will discover a large amount of nutrient has settled in the container which will be disappointing when you discover the formula you have been using for the last year has been without a great deal of nutrients the plants require.



ROCKWOOL

Rockwool is the medium used in hydroponics because it retains moisture and has no organic matter, it is very well suited for hydroponic systems. Rockwool is in fact fiber spun from rock in order to make wool. Its appearance is very similar to fiberglass. Rockwool is more user friendly than fiberglass and will not make your skin itch. Here is some very important information you need to know when using Rockwool. There are two types of Rockwool available, absorbent and non-absorbent. Be sure to purchase the ABSORBENT type of Rockwool for your hydroponic system.

Rockwool is packaged in large bails that are shrink wrapped. On average 1 bail of Rockwool will fill approximately 60, 1 gallon grow containers. 1 gallon grow containers are 6 inches wide and about 10 inches in height. 1 gallon containers are very well suited for hydroponic grow systems because "there is enough Rockwool in a 1 gallon container to sustain the life of a plant for up to 3 days without watering". This is a safety design, if you use smaller grow containers you run the risk of plants dying if for some reason a water pump stops working while you are away.

To begin with you will need a large rubber garbage can.. open the bail of Rockwool and break the Rockwool into smaller pieces placing them into the garbage can. You will need to fill the garbage can with water and use a large stir stick to mix the Rockwool in the garbage can. Chances are you will only be able to put half a bail of Rockwool into a garbage can for mixing. Continue to stir until the Rockwool looks like thick soup.

Now that the Rockwool has been mixed properly it is time to add PH DOWN. Not many people know that when you use Rockwool for the first time the PH is at a level of 9. If you don't add PH DOWN to the Rockwool to adjust the PH to 6 your plants will not grow after being transplanted. You will be amazed at how much PH DOWN is required to achieve a PH of 6. It may actually take up to half a liter of PH DOWN. Just add the PH DOWN a little at a time, mix thoroughly then test the PH level before adding any more PH DOWN.

When the PH is at a level of 6 you are ready to start filling containers and transplanting clones. To fill a 1 gallon container just scoop the Rockwool mix from the garbage can and let the excess water drain from the container. Lightly press the Rockwool into the 1 gallon containers. Do not compact the Rockwool into the 1 gallon container. The best thing is to leave the maximum amount of air space in the Rockwool so more oxygen can be available to the roots of your plant.

Fill the 1 gallon containers to within 1 inch from the top, then make a small opening in the center of the Rockwool and place the clone into the spot. Fill in the rest of the opening with more Rockwool, now your almost ready to place the container into the grow system.

One last step is required at this time. Cover the surface of the Rockwool with grow rock. Grow rocks are round ceramic rocks, usually red in color and about 3/4 of an inch in size.



Grow Rocks

The purpose of grow rocks is to prevent light from contacting the Rockwool. When light comes into contact with moist Rockwool algae will start to grow on the surface. Algae wont kill the plants but it is not desirable to have algae in your hydroponic grow system.

Algae consumes nutrients that plants need to grow and will subtract from the hydroponic solution the plants are using. Once the grow rocks are placed on the surface of the Rockwool you may transfer the transplanted clone in the container to a flood table or grow tube.

Grow rocks will last forever, save and reuse them. As well Rockwool can be saved and reused for future crops. It is much easier to wait for the Rockwool to dry out before you begin to break it up into smaller pieces.



MOTHER PLANTS

Mother plants are essential to keep a constant supply of fresh clones ready. A mother plant is a large plant kept in a stage of growth (18hrs light). These plants will not produce bud because of the longer light cycle and growth formula of nutrients.

It is recommended that mother plants be kept in large 10 gallon containers filled with soil for low maintenance. A quality mother plant will be 100% female in gender, the cuttings will become clones and replicate the characteristics of the mother plant.

Plants grown with our hydroponic system can be transplanted into a soil mixture "as is" with the Rockwool they were grown in. When selecting a mother plant for indoor production choose the healthiest plant, short in stature with thick branches and very bushy in appearance.

Mother plants can be fed by hand every 3rd day, be sure to alternate feeding the mother plants with watering to flush out excess nutrients. Over feeding mother plants will result in a toxic buildup in the soil mixture, signs of overfeeding are browning of leaves, and tips of leaves drying and breaking.

If you have over fed your mother plants be sure to only water the plant for 10 days to flush out the build up of nutrients. In extreme cases of toxic nutrient build up, take the mother plants to a bath tub and run water over the soil with a garden hose for 15-20 minutes, this will remove all excess nutrients.

Ten days prior to cloning be sure to stop feeding the mother plants and only water them, this will remove excess nutrients which will make your cuttings root faster. Mother plants should last 6 to 8 months before being replaced. To be safe keep 2 mother plants for every 1000w light in your bud rooms, example: if you have 4 - 1000w lights in the bud room keep 8 mother plants.

Mother plants will have a main stem growing from the soil container with branches every few inches, each branch will produce large leaves called "fan leaves". From each fan leaf a new shoot will grow that will either produce more branches or bud depending on the amount of light per day. When taking cuttings from the mother plants only cut the ends of branches leaving an average of 2 to 4 large fan leaves on the plant to produce more shoots for future cuttings.

A 10ft x 10ft room can easily hold 20 mother plants with a 1000w light bulb, this will provide enough cuttings to make up to 500 clones every 3 weeks.



Mother plant



Clone

Mother plants are to be kept on an 18hr light schedule and will do well in soil containers. Alternate feeding the mother plants with watering. Fluorescent lighting will also work well for mother plants in smaller rooms.

Be sure to water only for at least 10 days before cuttings are to be taken, this will speed up rooting of clones due to the lack of nutrients in the cutting.

Above is an illustration of where to take cuttings to clone plants with. Cuttings only require a large fan leaf, a stem and a new growth shooting out from the fan leaf.

Always leave a few fan leaves on the mother plants to encourage new growth for future cuttings.

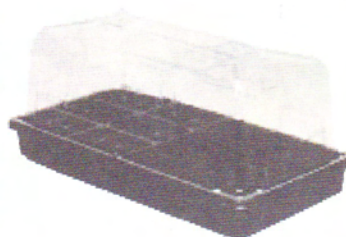


CLONING

When it comes to cloning we suggest the following. Purchase a proper cloning tray with a tall and clear plastic dome to keep the humidity in. You will also require Rockwool cloning cubes which should fit about 50 per cloning tray.

Always take a cutting that is about 3 inches in length and cut at a 45 degree angle with a new razor blade. Have a bucket of fresh water to place all the fresh cuttings in prior to the cloning stage. Once you have the Rockwool cubes soaked and ready for use squeeze out most of the excess water before placing them in the cloning tray. You should have a powder cloning product and a gel cloning product available for cloning.

First remove the cutting from the water dipping the clone stem in the gel product, then dipping in the powder product. This method gets the most cloning stimulant on the stem and increases the success rate for cloning. Once dipped press the stem into one of the Rockwool cubes and continue until the cloning tray is full (50 Clones in 1.5 inch cubes)). After the clones have been placed in the tray pour a teaspoon of water around the base of each stem to activate the root stimulant .



Cloning Tray with Dome

One week before cloning stop feeding your mother plants and only flush them with water. It is a fact that cuttings root much faster with the absence of nutrients within. This means if you feed your mother plants growth nutrients before cloning, it will take more time for your clones to root.

Spray the clones once a day with normal tap water in order to remove any nutrients that may remain in the cutting. This will encourage faster root growth. Place the cloning trays under a fluorescent grow light 24 hours a day until rooting is complete this usually takes 5-10 days.

As a rule it is smart to make twice the amount of clones needed, that way you have a much better selection to choose from, if a percentage of the clones don't survive you will still have a quite a few extra. Sometimes spider mites will find their way into a cloning tray and all 50 clones in a tray could be destroyed.



Rockwool Cubes



FOOD FORMULAS

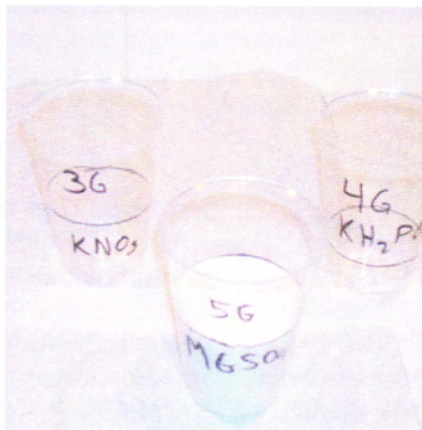
It is a fact that brand name hydroponic food is very expensive. Companies that manufacture hydroponic food will also tell you that other supplements are necessary. Without previous experience its very difficult to know what works and often times you are just buying additives for your plants that should already be included in the basic food you have already purchased.

If you are growing marijuana on a large scale (100-1000 plants) brand name hydroponic food will cost a fortune. We have developed a hydroponic food formula that guarantees amazing results for all indoor varieties. Our food formula can save you a few hundred dollars or more per month in additional costs. Brand name hydroponic food can cost as much as \$100 per gallon for part A, and another \$100 per gallon for part B which could make up to 500 gallons once mixed. If you require 500-1000 gallons of nutrient per week brand name hydroponic food is not cost effective.

To make our formula you will need to purchase Calcium Nitrate (50lb bag @ \$39.99) Potash (50lb bag @ \$39.99) Mono Potassium Phosphate (50lb bag @ \$39.99) Potassium Nitrate (10lb bag @ \$29.95) Magnesium Sulphate (50lb bag @ \$39.99) and Trace Elements (10lb bucket @ \$39.99). The total nutrients as listed will make approx 30,000 gallons of hydroponic food. The average cost to fill a 100 gallon reservoir with our hydroponic formula is about \$2.00.

To begin with you will need a scale to weigh the nutrients and clear plastic cups. Start with the Calcium Nitrate, fill the plastic cup to the desired weight, then use a black permanent marker to draw a line around the cup at the desired level. Once this is done write the name of the nutrient on the cup, as well the number of sequence and a letter to indicate Bud (B) or Grow (G).

Continue until you have a set of measuring cups for the bud formula, and a set of cups for the Grow formula. Now it will be easy to mix the hydroponic food next time without having to weigh each ingredient.



Once all the ingredients are ready you must mix them in the correct order. If you change the order of the mix the nutrients will bond together and the food will become useless. Start by filling a rubber garbage can with **HOT WATER**. This can be done with a garden hose attached to any household tap. You will also need a large stir stick, approximately 4ft in length x 2 inches x 3 inches. Each ingredient should be mixed very well for 1 minute or until the solution is clear in appearance. The ingredients are listed in sequence below.

The Bud formula listed below will make approx 80 gallons at 900 PPM

1B	CaNO3	315 grams	Calcium Nitrate
2B	K2SO4	128 grams	Potassium Sulphate
3B	KH2PO4	104 grams	Mono Potassium Phosphate
4B	MGSO4	213 grams	Magnesium Sulphate
5B	Trace	34 grams	Trace Elements

The Grow formula listed below will make approx 80 gallons at 700 PPM

1G	CaNO3	224 grams	Calcium Nitrate
2G	K2SO4	28 grams	Potassium Sulphate
3G	KNO3	86 grams	Potassium Nitrate
4G	KH2PO4	46 grams	Mono Potassium Phosphate
5G	MGSO4	132 grams	Magnesium Sulphate
6G	Trace	24 grams	Trace Elements

Begin filling the reservoir with cold water while the formula is being mixed. Once the formula is ready, pour it from the garbage can to the reservoir and finish filling with cold water to the desired level. Once the reservoir is full turn on the water pump and let the food run through the system for a few minutes, check the PH and adjust to 6 if needed.

If the reservoir is slightly larger or smaller then adjust the formula to suit your needs, example: You filled your reservoir with the Bud formula as per the directions and your at 1200PPM. Multiply the weight of the nutrients by 0.75 to get the new formula at 900PPM.

The recommended PPM (Parts Per Million) is 900 for Bud and 700 for Grow. Some growers may say that 1200PPM is better because the plants are getting more food. The truth is that 48hrs after your reservoir has been filled, the level will drop by 25%, the PH will also drop to a level of 5, but the PPM will increase to about 1100. Top up the reservoir with tap water and adjust the PH back to a level of 6 every other day. We know from experience that plants produce just as much bud with 900PPM as they do with 1200PPM.

Raw nutrients absorb humidity and will eventually bond together like cement if not covered or stored properly. Never leave bags of nutrients open after use.



FLAVOR ENHANCEMENT

Many people who smoke marijuana prefer the flavor associated with plants grown in soil. It is a fact that growing with soil may enhance the taste of the marijuana when smoked due to certain organic properties that hydroponic plants often do not provide.

From experience we know that it is possible to add organic flavor to plants grown in hydroponic systems as follows:

Our method of enhancing flavor to the plants requires the use of Sea Weed extracts. Sea Weed extracts contain 99 organic micro nutrients that can not be found in most fertilizers.

When purchasing the Sea Weed extract you will notice it is in a bottle and looks much like thick black liquid. Be sure to purchase maximum strength extract, not diluted.

Measure out 30ml of the extract and mix in a 2 liter container of hot water, this will assist in the mixture to a large reservoir. Once ready simply pour into the large reservoir and turn on your water pumps for a few minutes to complete the process.

We suggest that the Sea Weed extract be used in your reservoirs one time at week 1 of grow, one time at week 1 of bud, one time at week 3 of bud, and one time at week 5 of bud.

Keep in mind that too much of a good thing is a bad thing, we strongly caution growers not to use more Sea Weed extract than suggested.

Sea Weed extract can also be sprayed on plants every other week if desired when the grow lights are off. The suggested mix is one teaspoon per gallon. Purchase a garden sprayer to make application of spray easier.

Final Flush:

In addition to enhancing organic flavor of the bud grown with our hydroponics system it is necessary to remove all excess nutrients prior to the harvest date, this is commonly referred to as the final flush. It is best to provide plants with tap water only for the last 2 weeks of the bud cycle. There is no need to adjust the PH of tap water as we are only leaching out nutrients that will otherwise prevent the finished product from burning and tasting great.



PH

Plants require food formulas to be between the PH of 5 and 6. This refers to the alkaline or base properties of the water. There are many different nutrients available in food formulas. Not every nutrient is absorbed at the same rate depending on the PH level of your solution. Some nutrients are more easily absorbed at a lower PH of 5, while others are better absorbed at a PH level of 5.5 or 6.

When making a hydroponic food for your plants set the PH to a level of 6. Over a period of 48 hours the PH will drop to a level of 5. This is the best situation to allow a chance for all nutrients to be most readily available to your plants. After 48 hours refill your hydroponic reservoir and add PH UP to reset the PH to 6. Hydroponic reservoirs should be completely drained after 4 days and refilled with fresh nutrient for optimum growth.



PH Meter

PH can be measured with digital meters which are often called PH Pens. Always rinse your PH meters with tap water after every use. When you purchase your pen or similar PH meter it will come with instructions for use and a bottle of PH solution to calibrate the pen. The solution is set to a certain PH that will verify if your pen is calibrated or not. Digital PH meters can cost as little as \$100 or as much as a few hundred from your local hydroponic store.

The other method is to purchase a PH test kit from any pet store that sells aquarium supplies. The PH test kit includes a small vile to fill with sample nutrient, a PH color chart and Bromothymol Blue drops. Once the vile has been filled with a sample of nutrient add 3 drops of the test solution. Then shake the drops in the vile to see the results. The nutrient solution should change color, then compare the color to the chart included with the test kit. PH test kits cost about \$5.00 and are very accurate. This method works very well and it is always good to have around in case the digital PH meter fails for some reason (dead batteries etc).



PH Pen

As important as PH is the strength of food in the hydroponic reservoir. The strength of food can be measured in Parts Per Million (PPM). Digital PPM meters are available at local hydroponic stores which can tell you the strength of your nutrient solution. We suggest that the strength of your nutrient solution be at 700PPM for growth, and 900PPM for bud.

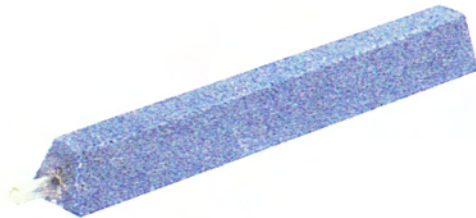


OXYGEN

The leaves on your plants process light and Carbon Dioxide. The roots on all plants require oxygen to stimulate rapid growth. Oxygen can be made by mixing Hydrogen Peroxide with water and nutrients then fed to your plants, however this can be costly and have a minimal effect on root growth. There also is a chance of harming the plants if you add too much hydrogen peroxide to the nutrient solution. We do not recommend using hydrogen peroxide.

When growing plants in a hydroponic system we suggest the use of an air pump with tubing and air stones from a pet store. This is the same system you would install in a fish tank.

Install the air stones in the hydroponic reservoir to ensure the maximum amount of oxygen is available in our nutrients at all times. This method is inexpensive and very effective maximizing plant growth. Leave the air pumps operating 24 hours a day for best results.



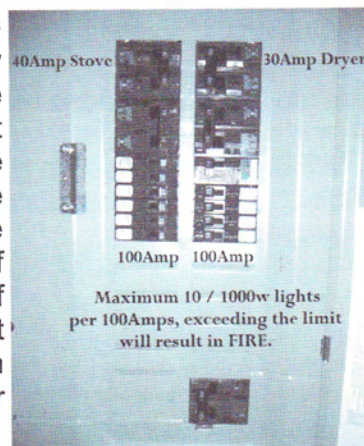
Air Stone



ELECTRICITY

Electricity can be very helpful when used properly or very harmful if you do not understand its properties and limitations. This section explains how to safely push the limits of electricity that you have available.

To begin you must examine your electrical panel before planning the maximum amount of lighting in your grow room. The most common type of electrical service available to you will be 200 amps. When you look at your electrical panel on a 200 amp service you will see that there are two rows of breakers on your panel. The breaker for the clothes dryer is on one side and the breaker for your electric stove is on the other. Each row of breakers on your panel can not exceed 100 amps. If you exceed the limit on your electrical panel wires will melt and cause fire. This means you can not use more than the equivalent of ten 1000w lights on one side of your electrical panel.



The electrical panel is designed with two wires carrying 100 amps each running into your residence. Most of the breakers on your electrical panel are rated at 110 volts. Circuits with 110 volt rating are usually linked to light switches in your home, electrical outlets etc. The breakers that supply electricity to the clothes dryer (30 amp) and stove (40 amp) circuits are rated at 220 volts. What this means is that the when used properly a 30 amp circuit at 220 volts will power up to six 1000w lights and a 40 amp circuit can power up to eight 1000w light bulbs.

When you visit your hydroponic store they will be able to provide you with a timer board that plugs directly into your stove or dryer outlet. The board will include a mechanical timer, and several outlets at 110 volts to plug the equipment such as 1000w lights, fans and pumps into.

Timer boards split the current from 220 volts to 110 volts and provide the grower with multiple plugs to operate many more lights than a standard 15amp outlet. In the photo you will notice a typical 40amp timer board which can plug directly into your stove outlet. This board will power up to eight 1000w lights and has additional plugs for fans and pumps.



40amp Timer board



FLIP SYSTEMS

Light flip systems are recommended when more lighting is required. The benefit if a flip system is that one light ballast can service two 1000w light bulbs. The cord that normally runs from the ballast to the light is now plugged into the flip system, then 2 cords run from the flip system to 1000w light bulbs in separate bud rooms (12 hours). A standard timer is used to activate the flip system every 12 hours.

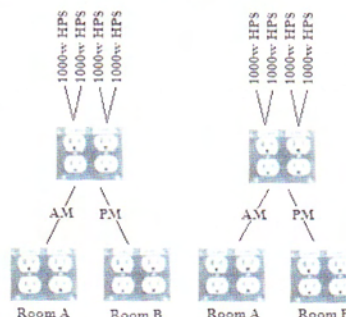
Flip systems can be in a variety of sizes such as a 4 ballast unit that operates eight 1000w lights, or a 6 ballast unit that operates up to twelve 1000w lights, or an 8 ballast unit that can operate up to sixteen 1000w light bulbs.

The advantage of flip systems is that the ballasts are always on and at full power, it otherwise takes time for lights and ballasts to reach full power when first turned on. Power is transferred from one room to another allowing the grower to use more lighting safely. It would be difficult to synchronize 2 timers that both service eight 1000w light bulbs without running into problems. Another advantage is that it cost less to purchase a flip system than it would cost to purchase eight ballasts for your lights.

Here is an example of what you can safely do with a flip system. A six light flip may be installed to a circuit breaker on each side of your electrical panel. Now you have two six light flips which means you can operate two bud rooms with 12 lights each without overloading your electrical panel. This provides you with a total of 24 /1000w light bulbs to bud plants with. It is also possible to have up to four more 1000w lights operating from a circuit on each side of the 200 amp panel without the risk of fire.

Without this knowledge someone might try to install another 40 amp breaker and circuit into their electrical panel, the result could be that they are now using two 40 amps circuits @ 220 volts (which totals 160 amps @ 110 volts) from a panel that is only made to provide 100 amps @ 110 volts. The maximum amount of 1000w lights that can safely be used on a 200 amp electrical panel would be approx eight on each side of the panel (16/1000w) with a flip system $\times 2 = (32/1000w)$. This would leave a remainder of 2000w available on each side of the breaker panel for fans, pumps, etc.

Ballasts are plugged into light flip board and operate 24hrs a day. This is an example of a board that will power 16 lights with 8 ballasts.

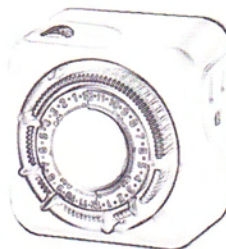




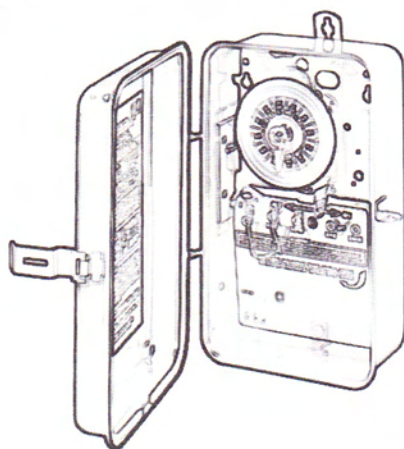
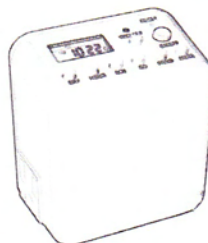
TIMERS

Timers are essential to indoor grow operations to control fans lights and water pumps that feed your plants. The three most popular types of timers are listed as follows:

Standard timers can be purchased from any hardware store and are useful for turning exhaust fans **On** and **Off**. Most often these timers can be set manually by inserting pegs at the desired time for **On** and **Off** settings.



Digital timers are a growers best friend. These timers allow the grower to program up to **12 On and 12 Off settings** per day. Digital timers are great for programming CO2 cycles and can be synchronized with other timers for your exhaust fan settings. The advantage of digital timers is that (a) they have a rechargeable internal battery back up in case of a power outage (b) digital timers can be programmed for as little as 1 minute on and 1 minute off if needed. When purchasing a digital timer from your local hardware store be sure to select one with the third prong (ground) as this will service more devices. Digital timers can be purchased for about \$20 and are the best investment you can make when operating a hydroponic CO2 grow room. All operations in a hydroponic grow room can be serviced with a quality digital timer.



Mechanical timers are used on heavy duty electrical panels. These timers are made of steel construction and have heavy gauge wiring that can handle enough electricity to service up to eight 1000w lights at a time

Time settings can be adjusted by pulling the dial outward and turning to the desired time, a spring will pull the dial inward to running position when the time has been set. The **On** and **Off** settings on this timer can be moved by unscrewing the pointer then tightening again with your fingers.



REFLECTORS

Many reflectors are available for indoor growers today to suit different applications described as follows:

Horizontal mount reflectors can be as simple as the bat wing style or also can be air cooled. These reflectors concentrate 80% of the useable light straight downward. Reflectors with horizontally mounted bulbs usually provide light to a smaller area (2ft x 4ft) than reflectors with vertically mounted bulbs (4ft x 4ft). When using a horizontal mount reflector be sure to keep the light about 16-20 inches away from the plants to prevent scorching the leaves.



Bat wing



Air Cooled

Vertical mount reflectors are available in two different styles (a) parabolic, looks similar to an umbrella (b) and flat tapered style. Both styles of vertical mount reflectors usually have the bulb mounted up inside the reflector, the light is first cast outward, then reflected downward. Most of these reflectors will provide and excellent source of light to an area 4ft x 4ft in size.



Parabolic style

Most parabolic reflectors have the light bulb mounted up inside to cast the maximum amount of light downward onto an area of 4ft x 4ft. It is possible to cover an area of 6ft x 6ft if you shorten the length of the mounting bracket so that half the light bulb is inside the reflector and half the bulb is exposed below the bottom of the reflector. What happens is that 50% of the light is reflected downward and 50% of the light is reflected outward past the width of the reflector.

We know that flat tapered reflectors work best with a shortened mounting bracket, this is how we can cover an area of 6ft x 6ft which makes it possible to increase the size of the crop per light. The other advantage of vertically mounted bulbs is that you can hang the light within 6 inches of the top of plants without scorching the leaves. Use 1000w Super full spectrum bulbs (145,000 lumens) for best results.



Flat tapered style



LIGHTING

There has always been a great deal of controversy in regards to which is the better light for plants to grow under. Many light bulbs are available which are suitable for different applications. Listed below are the most common types of lighting:

Metal Halide light bulbs emit a blue spectrum of light which is purpose made to replicate the sun during summer months when plants are in a growth stage. Metal halide light bulbs are available in a variety of different sizes such as 250w, 400w, 600w, 1000w, and super 1000w. **Make sure the ballast used is the right match for the bulb you have. You can't operate a metal halide bulb with a ballast made for a sodium bulb.**

The growth of plants is limited to the amount of light, and the type of light they have available. More light equals more growth and more bud. The average 1000w metal halide light bulb emits 100,000 lumens of light. Lumens are the measure of light available to plants. There is also a Super 1000w metal halide bulb available which emits 125,000 lumens of light. Metal halide lights do not work very well for production of bud and should only be used for growth stages of plants on 18 hour cycles.



Halide

High Pressure Sodium bulbs are purpose built to replicate the harvest sun and emit a yellow red light spectrum which enhances plants flowering and or bud production. High pressure sodium light bulbs are also available in different sizes from 250w, 400w 600w, and 1000w. Depending on the space you have available you might need a 400w for growing a few plants in a closet, or 1000w for a small room. The maximum lumen output for a high pressure sodium light bulb is 125,000 lumens. These bulbs are not very good for 18 hour cycles of growth for plants and should only be used during flowering or bud production.



Sodium

Combination, Halide / Sodium lighting. Commonly referred to as full spectrum bulbs. These bulbs work very well for all stages of growth, flowering or bud production.

Many manufacturers make similar bulbs, however ask your hydroponic supplier for a horticultural style bulb. Full spectrum bulbs look just like sodium light bulbs and emit 125,000 lumens.

Super full spectrum bulbs out perform every other light bulb on the market, and are rated at 145,000 lumens which is the maximum output for any 1000w bulb made today.

Use combination light bulbs in every grow room you have for the best results, awesome for 18 hour and 12 hour stages of growth.



Super Full Spectrum

Fluorescent lights are very inexpensive and well suited for the stages of cloning. For best results purchase a fixture 48 inches in length that will power 2 - 40w light bulbs. You will be able to fit 4 cloning trays with 50 clones each under a 48 inch fluorescent light (total 200 clones per 48 inch fluorescent).

Fluorescent lights are available in many different styles of lighting from Cool Whites, Aquarium, Utility etc. For best cloning results purchase a full spectrum plant style light bulb from a hydroponic supplier.



48 inch fluorescent

If you need to enter a bud room while it is in darkness, be sure to use a trouble light with a green light bulb. Marijuana plants are very light sensitive and will automatically want to stop bud production if exposed to white light during periods of darkness. Plants can not detect green light. Green light bulbs can also be installed in a normal ceiling fixture in your bud room and turned on for inspections during darkness.



Finally remember to replace all light bulbs after 12 months. It may look like the light bulbs are working well after 12 months however the useable light spectrum of the bulb is almost gone and your plants are not producing as much bud as they should. It might seem expensive to replace 5 or 10 or 20 light bulbs but it is the best investment you will ever make.



FANS

Fans provide air movement and circulation indoors which is essential for plant growth. The importance of air movement is listed as follows:

- (a) Air movement can prevent temperature from rising to levels which could make it difficult for plants to grow. When room temperatures are near or above 100 degrees Fahrenheit Pythium may occur which could kill your plants very quickly.
- (b) Fresh air movement and proper exhaust of air will remove moisture, which will prevent mold or powdery mildew from growing on your plants or walls. Powdery mildew can greatly reduce the size of your harvest, it is not healthy to smoke marijuana with mold or mildew on it (poor quality).
- (c) Air contains a natural amount (4%-5%) of Carbon Dioxide gas which will accelerate plant growth. Providing quality fresh air to the plants is essential for any indoor grow room.
- (d) Strong air movement against plants will strengthen branches that will be supporting bud.

Fan Types

Oscillating fans are very helpful for moving air in grow rooms. Strong air movement can be created with these fans without harming your plants because the air continually changes direction from left to right.

Oscillating fans are very inexpensive to purchase and can be found at most department stores. It is strongly recommend you have a few of these fans in every grow room. Oscillating fans should be left on 24 hours a day.



Oscillating Fan

Ceiling fans can push air towards the floor, or draw air towards the ceiling. Most people don't think of installing ceiling fans in grow rooms, however they do help keep your room temperature even as most often heat will rise and floor temperatures will be cooler. Set your ceiling fans to push the hot air downward. You can purchase a basic ceiling fan for less than \$40 from any hardware store. Ceiling fans should be left on 24 hours a day.



Ceiling Fan

Furnace fans move large volumes of air very quickly and are most commonly used to extract or exhaust hot air from your grow room. These fans are rated in CFM (cubic feet per minute) and range from 1200CFM all the way up to 3000CFM. Furnace fans should be set on a timer and only be used when lights are on in your room. Flexible ducting can be attached to your furnace fan with a bolt on adaptor.



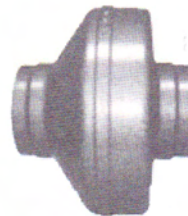
Adaptor



Flexible Ducting



Furnace Fan



Centrifugal Inline

Inline Centrifugal Fans work well for exhausting small grow rooms, however furnace fans out perform centrifugal fans on large scale applications.

Floor fans are helpful in moving air in one direction and are usually placed in a location on the floor somewhere. These fans are very large and move a lot of air quickly. With our hydroponic system we suggest you have at least 1 floor fan in any room with a minimum of four 1000w light bulbs.

All of the above listed fans have variable speeds to suit your specific application. If you are making use of all the fans listed you will achieve maximum results for growth of your indoor plants.



Floor Fan



CHARCOAL FILTERS

Before charcoal filters were available to eliminate smell from grow rooms people used ozone generators. Ozone generators work well but power surges will blow the fuse causing your ozone generator to fail. By the time you realize your ozone generator is not working it will often times be too late as everyone that travels near your location will also realize you have a grow room in operation.

With the potency of indoor marijuana being grown these days it is possible for strong smell to travel up to 500 feet from your location, in fact it is also possible to taste marijuana in the air from the same distance. Removing odor from your exhaust vent is a major priority if you plan to stay in the same location long term.

Charcoal filters have no moving or electrical parts that can fail and are 100% reliable always. Charcoal filters are affordable and easy to install. The best advice we can offer is to never use an ozone generator. All ozone generators will eventually fail.

Always install the exhaust fan as close to the charcoal filter as possible, this pressurizes the majority of the ducting with air that has already been treated for odor. If the exhaust fan is connected far away from the charcoal filter there is potential for a small air leak to suck untreated air into the ducting which could result in strong odor escaping from your grow operation.

Consult your local hydroponics supplier to find the correct size charcoal filter for your application. When setting up your grow room it is best to have 400CFM-500CFM of air movement for every 1000w light in use.

As an example if the grow room has six 1000w lights, a minimum 2400CFM furnace fan is required to remove air from the appropriate charcoal filter.



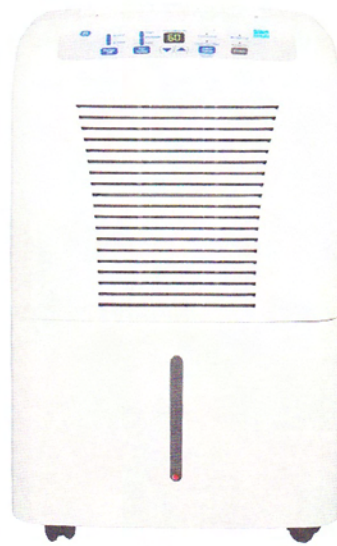
Charcoal Filters



DEHUMIDIFIERS

Dehumidifiers can prevent many problems associated with mold and mildew from affecting your grow room or home. When purchasing a dehumidifier size does matter and biggest is best.

Most dehumidifiers will have a fitting at the base to attach a hose for constant drainage, this is the suggested set up to prevent the reservoir from over flowing. If you do not attach a drain hose to the dehumidifier chances are the reservoir will over flow if not emptied at least twice a day.



Dehumidifier

Dehumidifiers can remove up to 2 gallons of moisture a day from the air in an area that you would not think has any moisture and much more will be extracted if used in a grow room. Let the dehumidifier operate 24 hours a day for best results.

Humidity can be very destructive to buildings, always vent exhaust air directly outside. Never exhaust air from a grow room into an attic. When exhaust air is vented into attics or crawl spaces mold will grow and humidity will rot wood structures very quickly which could cause a roof or floor to collapse under its own weight !



STAKING

When growing marijuana branches can become heavy and may even break if not tied to bamboo stakes.

Many growers have different methods for supporting the weight of branches however we prefer to use bamboo stakes. For our method 36 inch stakes will be best.



We always use 1 bamboo stake to secure the main stem at the 2nd week of the bud cycle (12hrs light) as illustrated.

At week 5 of the bud cycle it will be necessary to tie most side branches to the main stem of the plant. We know from experience even small side branches will break due to excessive weight of buds.

String works well for tying... but twist ties are much easier to use and available on 50ft rolls, just cut to length and one twist secures the branches with no need for tying.

Our method of growing marijuana requires that plants be set into a bud cycle (12hrs light) once they reach 14-16 inches in height.

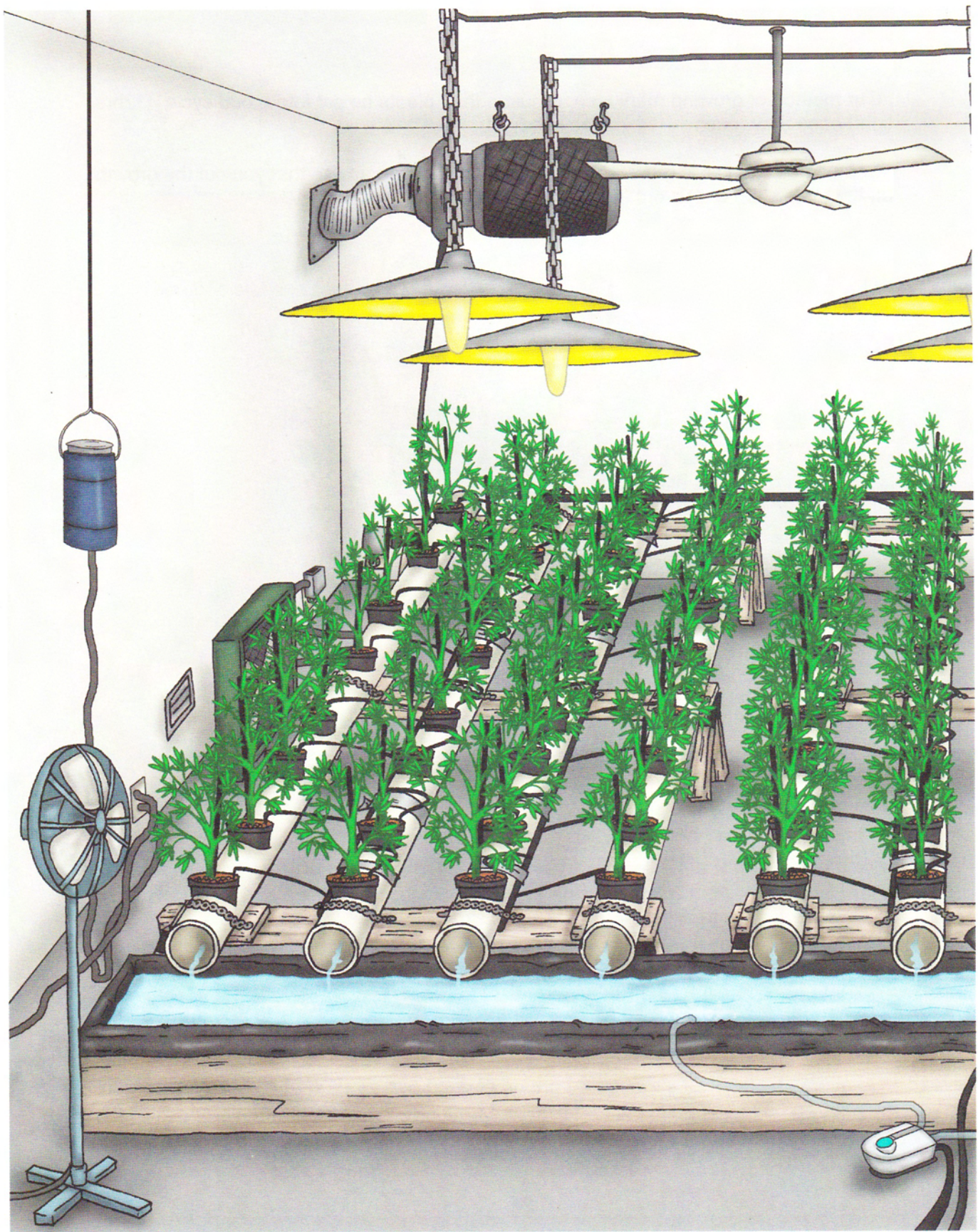
Sometimes plants will grow faster than expected so we advise that you cut the growth off the main stem to prevent further increases in size.

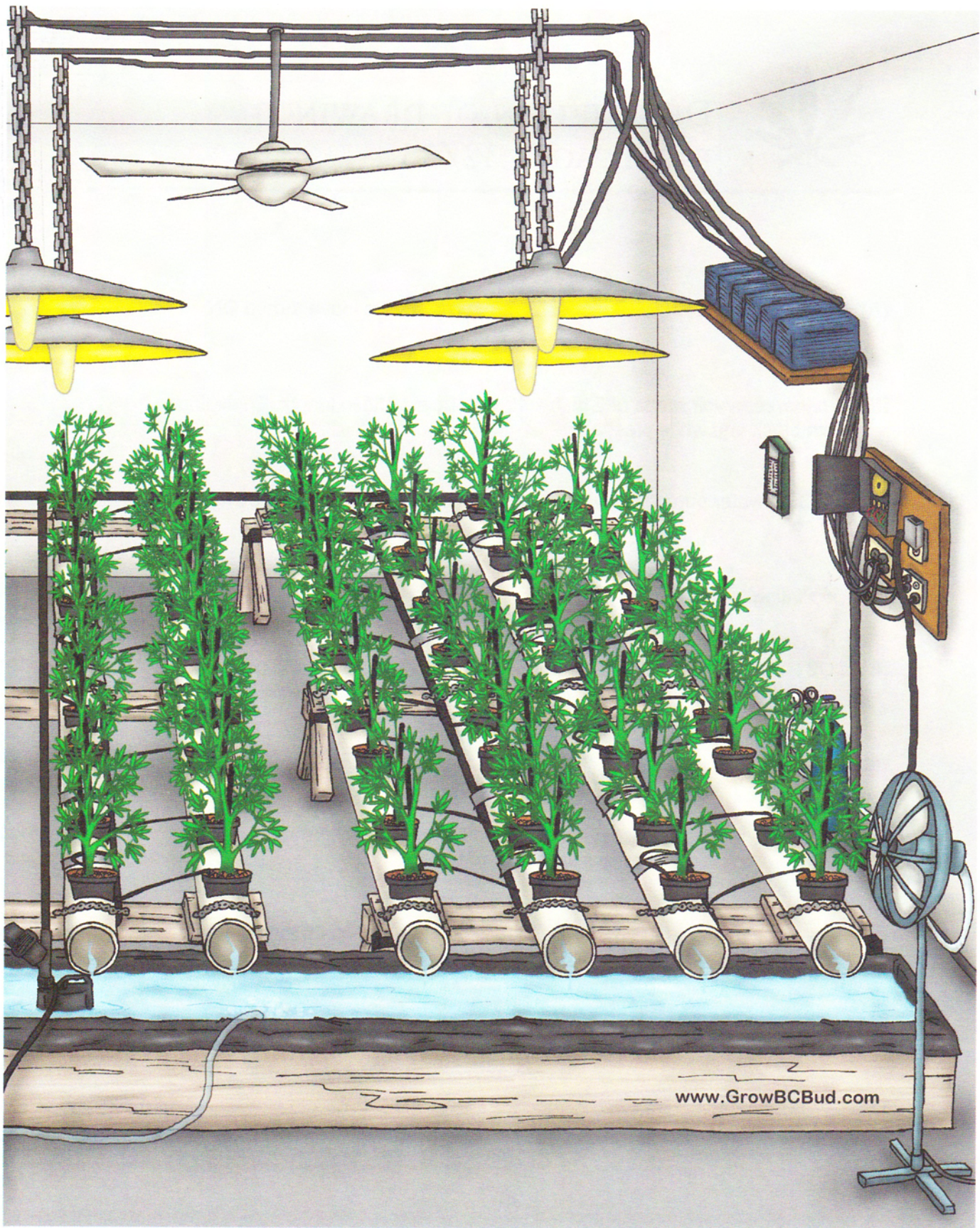


Once the growth is cut from the main stem the plant will not produce a main bud where expected. As a result the side branches will form into main buds. As illustrated it will be necessary to use several bamboo stakes to support the branches.

We know from experience that some strains of marijuana will produce more bud once the top of the plant has been removed due to the side branches producing bigger buds than normal. It would be wise to do a comparison with your plants to see if there is a substantial increase in the yield per plant.

On average plants will produce 60 grams of dried bud in 18 x 18 inches of space. In the past we have had plants produce up to 120 grams in the same amount of space as a result of removing the top growth of the main stem.



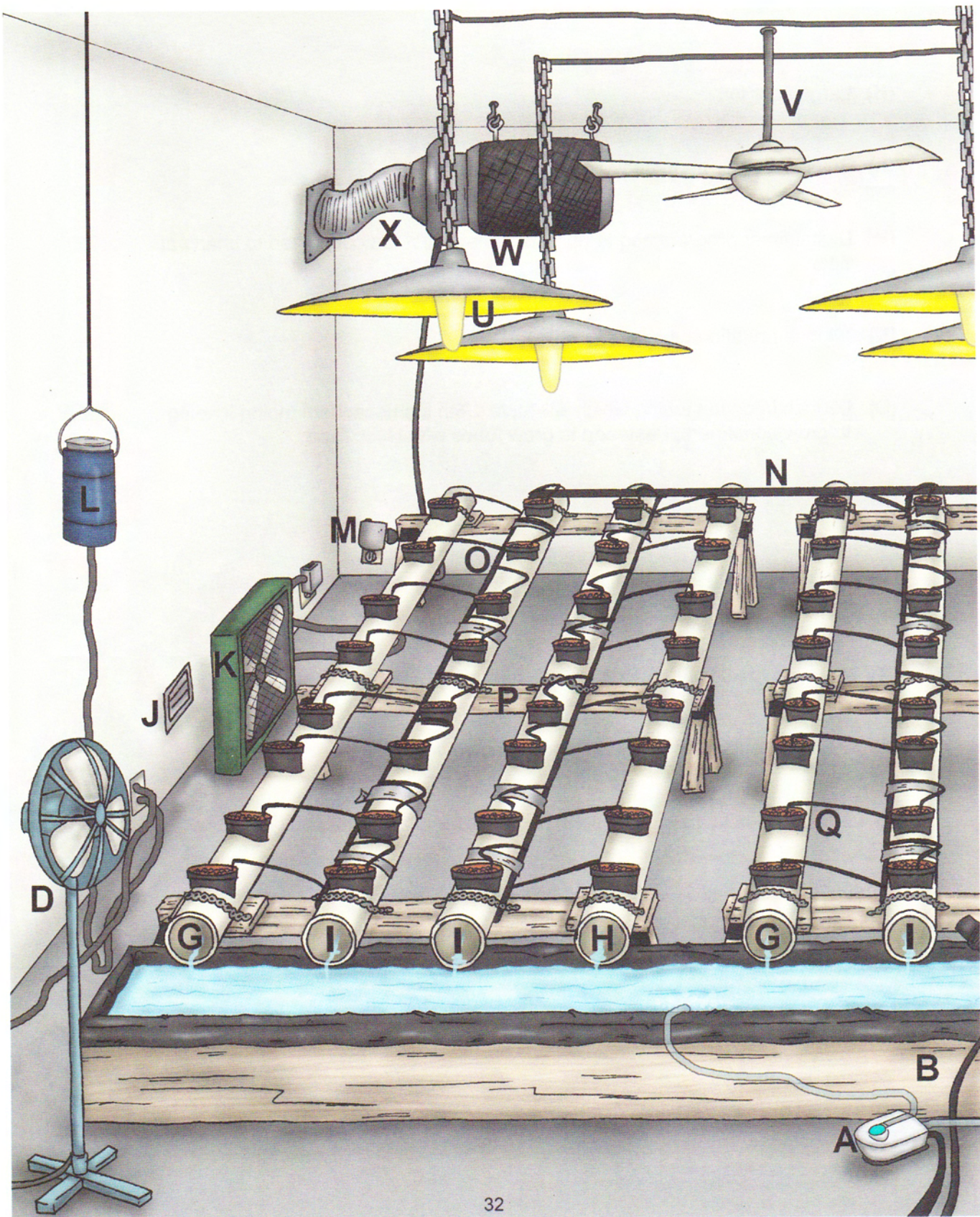


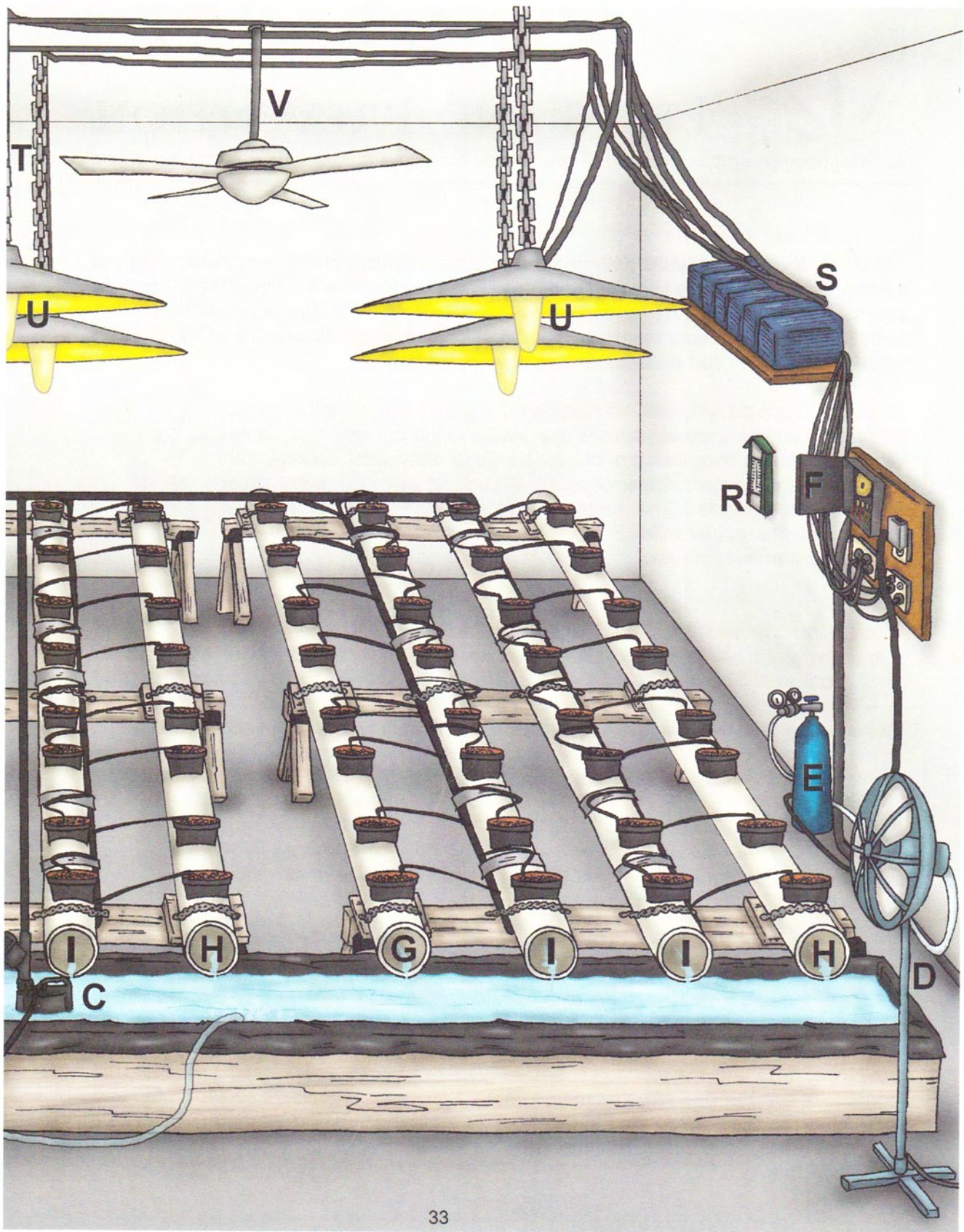


DESCRIPTION OF DRAWINGS FROM PAGES 32/33

- (A) Air pump connected to air stones in reservoir, always leave turned ON.
- (B) Custom reservoir made of 2 inch x 12 inch board 18ft in length. Triple lined with black and white plastic.
- (C) 900GPH water pump connected to inline filter and 3/4 inch plastic irrigation tubing.
- (D) Oscillating fan.
- (E) CO2 bottle with regulator. Solenoid is attached to regulator and plugged into a digital timer. Plastic tubing from solenoid is taped to the oscillating fan.
- (F) 40amp Timer Board.
- (G) Grow tube mounted to plywood with plumbers strap, can be moved to the right creating a walkway to service the room.
- (H) Grow tube mounted to plywood with plumbers strap, can be moved to the left creating a walkway to service the room.
- (I) Grow tubes permanently fastened to the sawhorse with plumbers strap.
- (J) Fresh air vent.

- (K) Large floor fan.
- (L) Sulphur burner hung above oscillating fan.
- (M) Digital timer programmed to operate the exhaust fan connected to charcoal filter.
- (N) 3/4 inch irrigation tubing.
- (O) 1/2 inch irrigation tubing which will have 1/8th inch spaghetti tubing leading to grow containers. Fastened to grow tubes with Duct Tape.
- (P) Sawhorse.
- (Q) Spaghetti tubing 18 inches in length, connected to watering spike and inserted to 6 inch grow container.
- (R) Minimum / Maximum thermometer.
- (S) 1000w Ballasts sitting on shelf provide power for lighting.
- (T) Light duty chains hang from plant hooks and support lights, easy to adjust.
- (U) 1000w Super Full Spectrum light bulbs with 4ft flat tapered style reflectors.
- (V) Ceiling fans.
- (W) Charcoal filter.
- (X) 12 inch diameter exhaust ducting.



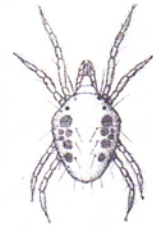




PESTS AND PREVENTION

Spider Mites are very small (0.2mm) in size but will destroy plants very quickly. Spider mites multiply at an incredible rate and are almost impossible to stop. These insects are usually found on the underside of the leaves and will start to create spider like webs that will cover your plants. It may be difficult to spot spider mites at first but in a matter of days they can cover an entire crop with webs.

Most often people will spray chemicals on the plants to kill spider mites. This is only a temporary solution as the spider mites will return. It is not healthy to spray chemicals on plants because they can become part of the bud and smoked. Other people will suggest using predator mites which eat spider mites. The problem with this is that there needs to be quite a few spider mites in order for the predator mites to live. You will end up with a room full of insects (not good).



Spider Mite

Treatment: We now know that it is possible to prevent spider mites from living in your grow room without spraying chemicals on your plants. Our best advice is to purchase **Insect Vapor Strips**. An Insect Vapor Strip is a chemical product designed to kill cockroaches and flying insects. This is how they work, the strip is placed in the desired area and will emit a vapor that kills bugs, in fact if an insect comes within 3ft of the vapor strip it will die quickly. This means that if you place 1 Vapor strip under each grow light an area of 3ft in every direction will be protected (6ftx6ft).

Vapor strips cost about \$12.00 and will last for 30 days before they must be replaced. If you follow this advice and always have Vapor strips in the grow rooms you should never see a spider mite. Insect Vapor strips can be purchased from hydroponic suppliers as well as garden centers and most hardware stores.



Vapor Strip

If for some reason you are trying to eliminate spider mites from a room that is already heavily infected here is what you do (a) Turn OFF all grow lights and exhaust fans for a period of 24hrs (b) Place one brand new Insect Vapor Strip under each light in the grow room (c) Purchase a can of chemical fogger designed to kill insects. A chemical fogger is a canister that will automatically discharge the chemical once activated and completely fog the grow room. Let the fog remain in the infected area for 24hrs to kill all spider mites. After 24hrs resume growing as before, lights on etc. This method is 100% effective.

If for some reason you enter the grow room and find plants that have fallen over with the grow pots still standing take a close look at the base of the plant near the soil. Rats might be chewing through the base of your plants in much the same way loggers cut down trees.

Marijuana plants are very durable and as long as the base of the plant has not been completely chewed through you can stake the plant upright and it will continue to grow without hesitation.



Treatment: Our best advice is to place a chemical poison somewhere in the grow room near the reservoir. When rats eat the poison they become very thirsty. The rats will jump into your reservoir to quench their thirst. Rats can not swim for long periods of time and will drown in your reservoir over night. In the morning just remove the dead rats from the reservoir.

If growing in soil just place a large bucket of water near by for the rats to climb into. As long as the water level is 6 inches below the top of the reservoir the rats won't be able to climb out.



POWDERY MILDEW

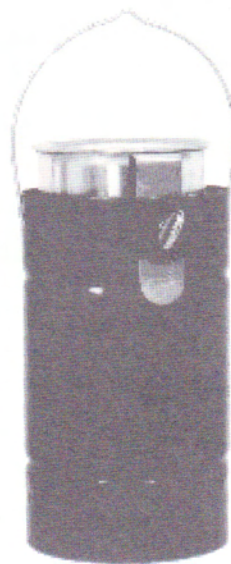
When air in the grow room contains too much moisture Powdery Mildew can grow on leaves of the plants. This can happen when you have poor ventilation in the grow room and may also occur when you have large amounts of water exposed to the environment as associated with flood tables. Once the humidity is removed from the grow room (dehumidifier) the mildew will die. If you are unable to fix the problem with increased ventilation you may spray chemicals on your plants or use a sulphur burner as explained below.

Powdery Mildew probably won't kill your plants but it will clog pores in leaves and slow the growth of your crop. Once Powdery Mildew is well established in the grow room it can be difficult to eliminate. Chemicals can be purchased and sprayed on your plants that will help combat the problem, however these chemicals will become part of the plant and can be harmful when smoked. Even after you spray the plants with chemicals the powdery mildew will return.

The best way to eliminate Powdery Mildew is to use a sulphur Burner. A Sulphur Burner is a metal canister with a heating element that turns sulphur powder into a vapor.

Only use the sulphur for 15 minutes at a time every other hour to prevent powdery mildew from growing. Sulphur vapors will travel downward from the canister so we suggest that you hang the burner above an oscillating fan that will distribute the vapors across the grow room.

One sulphur burner will easily service a room up to 20ftx15ft. Be sure to top up the burner with sulphur every other day. Sulphur burners are inexpensive and may be purchased at most hydroponic stores.





CO2

When it comes to grow rooms a certain temperature should be maintained for best results. To begin you should install Min/Max Temp thermometers in each grow room.

Min/Max thermometers keep track of the current temperature, as well the highest and lowest temperature for the last 24 hours. When your room is in darkness the temperature should be 70 degrees Fahrenheit.



Min / Max

The maximum temperature for a grow room should not exceed 90 degrees Fahrenheit. If your room temperature reaches 100 degrees Fahrenheit and you are unable to reduce the temperature by any means possible you should invest in air conditioning or a water chiller to prevent the onset of Pythium.

Pythium is a disease that causes the root systems in plants to rot and stop working properly. Pythium may occur when the water temperature in your reservoir reaches exceeds 65-70 degrees Fahrenheit. If you ever encounter Pythium you will have to throw out all the plants and every bit of Rockwool etc. Then you will need to thoroughly wash every container, grow tubing and flush the plumbing out with a solution of 50% water and 50% bleach to kill the Pythium. Then wait a few days, flush the bleach out with fresh water and start again.

Before you decide to use CO2 (Carbon Dioxide gas), the grow room should be air tight preferably sealed with black and white plastic and tuck tape. The room should be operating at no more than 80 degrees Fahrenheit with all lights on. If all is well you should invest in bottled a bottled CO2 system.

Bottled CO2 systems have a regulator with 2 gauges. The first gauge shows how much CO2 is in the bottle. The second gauge shows how much gas is being released. There is a knob on the front of the gauges to adjust how much CO2 is released. An electrical solenoid is attached that will release or shut off gas as programmed by a digital timer.



Bottled CO2 System

Plants need CO2 gas when the temperature of your grow room reaches 90 degrees. CO2 for plants is like oxygen for humans. If you were jogging on a hot day oxygen would be beneficial in order for you to perform better. Plants require CO2 when temperatures increase as they are working hard converting light into energy for growth.

CO2 is not helpful to plants when the temperature is below 90 degrees Fahrenheit. CO2 will not be of benefit if the PPM, (parts per million) percentage of CO2 is not at a minimum of 1500, or 15% of the rooms capacity for air.

When using CO2 you must have digital timers to turn off the exhaust fans, and other timers to activate the solenoid attached to your regulator which releases the CO2. The CO2 is fed from your regulator through plastic tubing to an oscillating fan in your room. After the room is full of CO2, allow another 35 minutes for the plants to use the CO2 before the exhaust fan starts again.

The room temperature should jump from 80 degrees to 90 degrees in the first 10 minutes while the exhaust fans are off. Don't worry the room wont exceed 90 degrees if you set up everything exactly as instructed. The exhaust fans will turn on again 45 minutes after the CO2 cycle is complete. Because the exhaust fans are turned off the CO2 gas will be trapped in the room, this is the most effective way to ensure the plants are using all the CO2 provided.

A typical 12 hour light cycle will use 6 CO2 cycles per day. Here is an example of how to set the digital timers:

Light cycle begins at 6PM

6:45PM Exhaust Fan **ON**
8:00PM Exhaust Fan **OFF**
8:45PM Exhaust Fan **ON**
10:00PM Exhaust Fan **OFF**
10:45PM Exhaust Fan **ON**
12:00AM Exhaust Fan **OFF**
12:45AM Exhaust Fan **ON**
2:00AM Exhaust Fan **OFF**
2:45AM Exhaust Fan **ON**
4:00AM Exhaust Fan **OFF**
4:45AM Exhaust Fan **ON**
6:00AM Exhaust Fan **OFF**

CO2... 6:00PM **ON** - 6:10PM **OFF**
CO2... 8:00PM **ON** - 8:10PM **OFF**
CO2... 10:00PM **ON** - 10:10PM **OFF**
CO2... 12:00AM **ON** - 12:10AM **OFF**
CO2... 2:00AM **ON** - 2:10AM **OFF**
CO2... 4:00AM **ON** - 4:10AM **OFF**

Light Cycle Ends at 6AM

On average it costs \$0.50 per day per 1000w light (6ft x 6ft area) in bottled CO2 gas. As an example a room with 6 1000w high pressure sodium lights will cost about \$3.00 per day or \$90.00 per month.

Plants grown with CO2 produce 25% - 30% more Bud than plants grown without CO2. This means that if you average 1.5 lbs of dried bud without CO2 in a hydroponic system you will be averaging 2 lbs per light with CO2. In nature the air plants use has about 4 - 5% CO2 content. With indoor growing we can triple (15%) the CO2 in our grow room which in turn will produce faster growth and a much bigger yield.

There is a formula to determine how much CO2 is required to fill a room to 1500 PPM as follows, example:

First calculate the cubic feet of space in your room. $20 \times 15 \times 7 = 2100$ cubic feet

Now multiply 2100 cubic feet of space $\times 0.000015 = 0.03$

This means it would take 60 minutes to fill a room with CO2 if you set the regulator to 3 Cubic feet per hour (CFH)

$\times 2 = 6$ CFH will fill your room in 30 minutes

$\times 2 = 12$ CFH will fill your room in 15 minutes

$\times 2 = 24$ CFH will fill your room in 7.5 minutes

It's probably better to set the regulator for 10 minutes at 20 CFH because CO2 usually starts to freeze the regulator when it's are above 20 CFH. If the room is larger than 2100 cubic feet of space use 2 bottled CO2 systems to fill the room faster.

When used properly CO2 is the best way to increase crop production and weight of Bud. CO2 is odorless, colorless and can not harm you in any way. It is better to purchase small CO2 bottles (20lb size) and refill them more often as the large CO2 bottles can be back breaking to move.

When growing plants with our system we do not use CO2 for the first 2 weeks of growth (18hrs light). Plants would grow too fast if we used CO2 during this time and it would throw off our schedule for harvesting etc. We only use CO2 for the development of Bud (12 hours light).



FLOOD TABLES

Flood tables are very useful for certain applications in grow rooms. You can purchase a prefabricated flood table from your hydroponics store or you can build your own table. We suggest building your own table and will explain why.

Prefabricated flood tables are usually 4ft x 8ft in size. There are a few disadvantages to buying these tables:

(a) There is an edge 3 inches wide around the perimeter of the table for strength, this is unusable space.

(b) Prefabricated tables use through hole fittings usually $\frac{3}{4}$ of an inch in size. These through hole fittings become clogged by such things as dead leaves, Rockwool, and grow rocks which float towards the drainage through hole fitting. Once the through hole is clogged water builds up and may overflow from your flood table to the floor causing unwanted problems. **Our best advice is to always have a Wet/Dry shop vacuum near by in the event of a spill.**



Prefabricated Flood Table

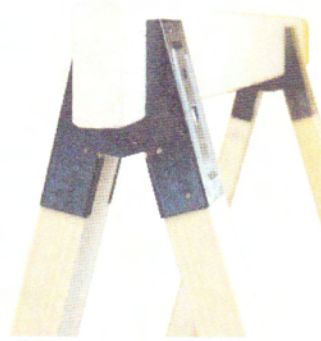
(c) Prefabricated flood tables are not made to support your body weight, plants only. As an example if your room is 10ft x 8ft in size you will only be able to fit two 4ft x 8ft tables in the room with 2ft x 8ft space to walk. You won't be able to step on to the prefabricated tables to swap plants around. You would need a room 10ft x 10ft to have a walking space between the 4ft x 8ft tables. As a result prefabricated tables are not well suited for every size room.

(d) You will need to purchase sawhorses and plywood to support your prefabricated flood table, why not just frame in your plywood with 2x4's and double line it with black and white plastic?

How its done:

To begin purchase sawhorse brackets as seen in the photo. Sawhorse brackets are very easy to use, just cut 2x4's to the desired length and insert them to make legs.

For a 8ft x 8ft flood table we suggest the legs should be about 16 inches in length at the low end and 20 inches in length at the high end. This makes it very easy to step onto the flood table when it is time to service plants etc. Next, install a 2x4 or 2x6 across the brackets to complete the sawhorse.



The legs at the rear of the flood table should be taller than the legs at the front so the water will naturally run downhill towards the drain hole where the reservoir is to be located. It is also a good idea to have at least two 2x4's installed between the sawhorses for additional support.

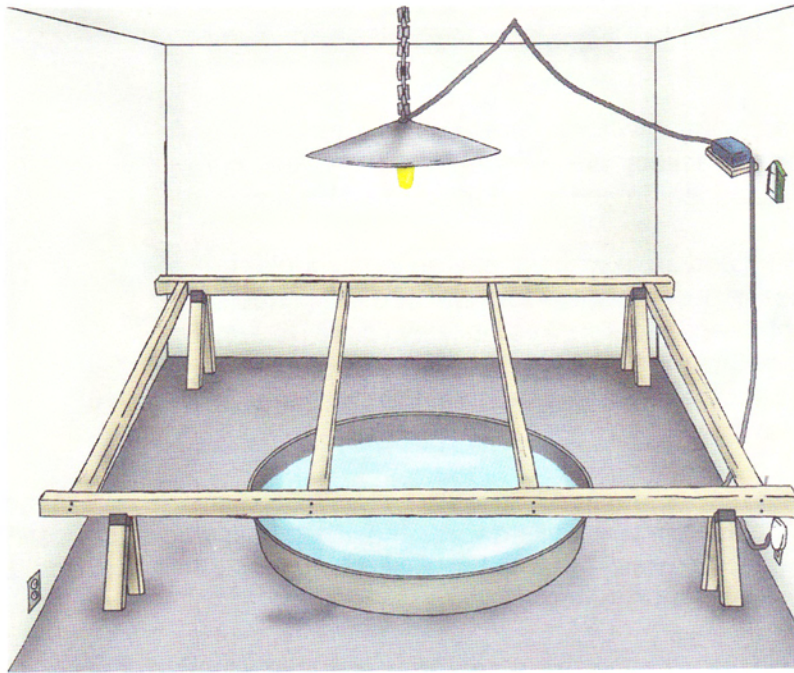
Use screws to fasten the brackets and 2x4's together. Now you're ready to top off the sawhorses with 3/4 inch plywood. Be sure to screw the plywood to the framework of 2x4's. Once the plywood has been installed cut a 6 inch x 6 inch through hole at the low end of the table where the reservoir will be located.

Now use 2x4's to make edges on the flood table and fasten with screws. Once the table is roughed in with plywood etc your ready to place 2 or 3 layers of black and white plastic on the table. Cut the plastic where the through hole is located and apply silicone around the through hole on the plywood. Press the plastic down to create a good seal and use duct tape to create a funnel towards the reservoir. To finish staple the plastic to the edges of the 2x4's and you're ready to go.

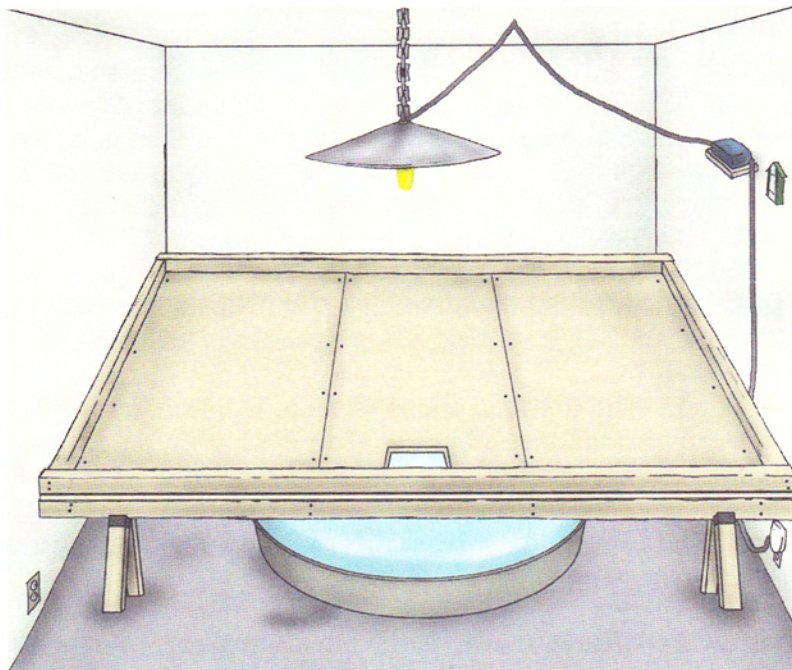
Before the flood table can be used you will need to install a reservoir, plumbing and water pump to be explained in the building a room section of this book.

Always run the irrigation line from the water pump to the high end of the flood table, this irrigation line will branch off and other irrigation lines will run from the main line to the low end of the flood table. The irrigation lines running to the low end of the flood table will have spaghetti tubing leading to each plant. **Never install spaghetti tubing into the main irrigation line running from the pump to the high end of the flood table. See illustration on page 43.**

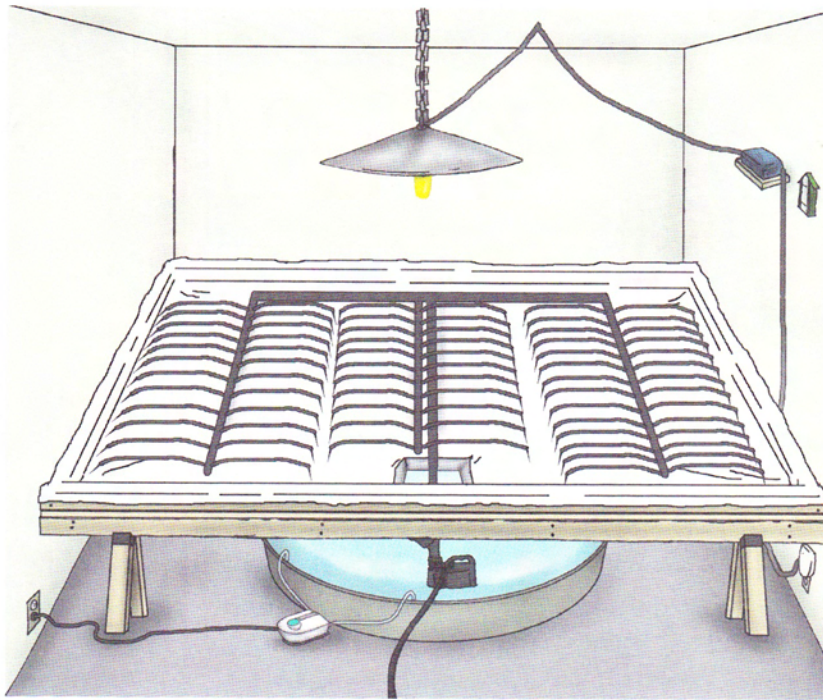
The advantages of building your own flood table are many: (a) much stronger can support your body weight and plants, up to 800lbs (b) custom size can be built to the entire width of your room any size (c) huge savings in money, \$140 for a 4x8 prefabricated table (d) huge through hole for drainage will never clog with debris.



Saw horses with 2x4 wood framing

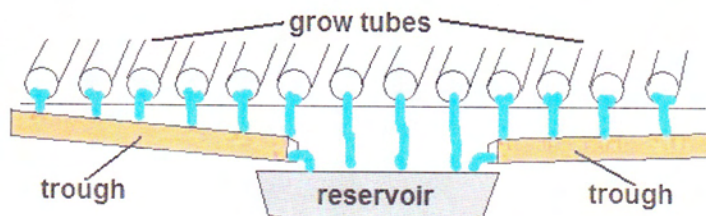
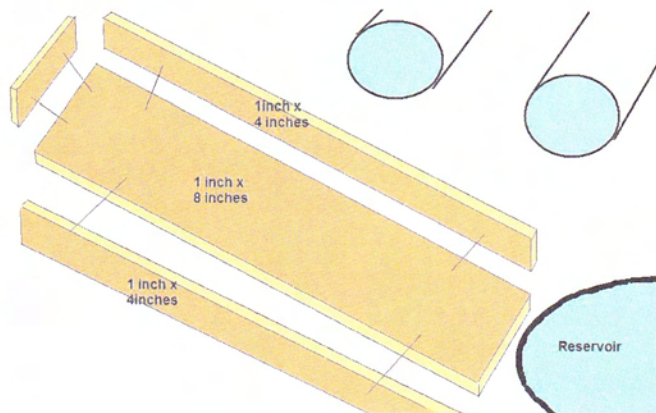


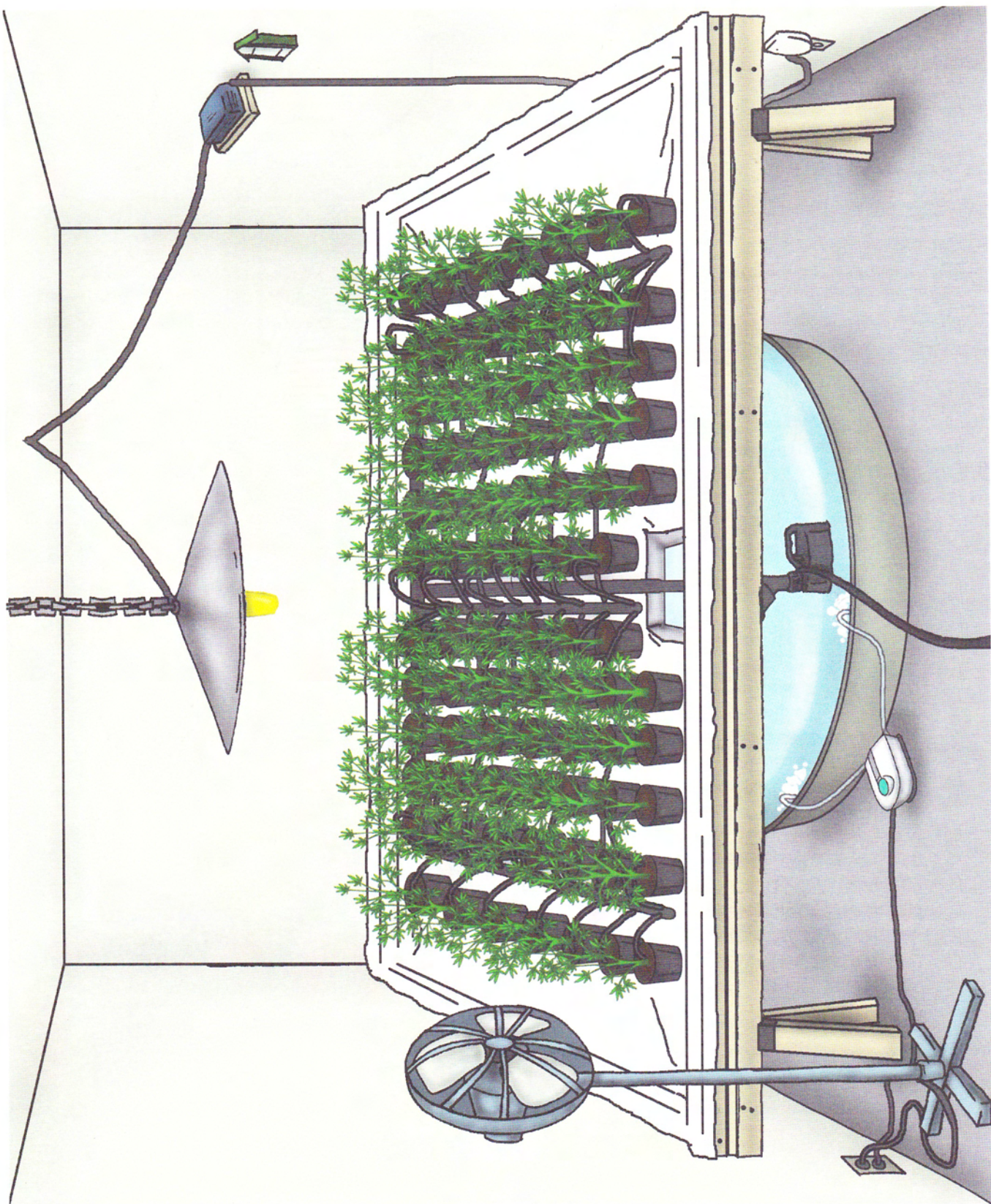
3/4 inch plywood fastened to framework with large drain hole
2x4's fastened to top edges of table will help retain water



The above photo illustrates how a typical irrigation system is installed once the flood table has been lined with 2 or 3 layers of black and white plastic.

This is a sketch of a watering trough. Troughs are helpful in catching water from grow tubes and directing to a reservoir. A simple trough will have a 1/2 inch plywood bottom 8 inches in width, then fasten 1x4 pieces of wood to the edges of plywood. Use black and white plastic to line the trough and secure with staples. Troughs can be supported with cement blocks and wood shims.







RESERVOIRS

Reservoirs are essential to all hydroponic systems and can be found in a variety of different shapes and sizes depending on the needs of your grow room. Professional reservoirs can cost a few hundred dollars depending on the size required. Or you could purchase a plastic swimming pool 12 inches height x 5 ft round, \$20 from any department store. The correct ratio is 1 gallon per plant. Example 50 plants = 50 gallon reservoir.

Another option is to make your own reservoir as follows:

- (a) using 2 inch x 12 inch wood boards frame the reservoir to size, this will differ depending on the configuration of the grow room etc.
- (b) then simply use black and white plastic to line the framework that has already been assembled. Always use 3 layers of plastic to prevent to possibility of pin hole leaks in the future.
- (c) once the lining has been placed into the framework begin to fill the reservoir with water from your garden hose.
- (d) when the reservoir is full of water staple the black and white plastic to the top edge of the 2 inch x12 inch boards.
- (e) be sure to place a rubber shower matt under the water pump which will prevent damage to the plastic liner.
- (f) reservoirs should be 12 inches in height. 5ftx12in swimming pool = 80 gallons
4ftx4ftx12in = 60 gallons / 4ftx6ftx12in = 90 gallons / 18ftx1.5ftx12in = 100gallons.

An advantage of building your own reservoir is that when positioned on a concrete floor the water temperature will remain much cooler which will help prevent the onset of Pythium. Always wipe the reservoir clean with a towel when changing nutrients, this will prevent salt build up that can effect PH. To drain a reservoir connect a garden hose to the water pump.

Always top up your reservoir and check PH every (2nd day) 48 hours, always change the hydroponic nutrients in your reservoir every (4th day) 96 hours. An easy way to remember is to change the nutrients on Calendar days with a multiple of 4, example: change nutrients on the 4th, 8th, 12th, 16th, and top up on days like 6th, 10th, 14th etc.. Odd number days ,3rd, 5th, 7th etc, are days off !



GROW TUBES

Our hydroponic system makes use of 6 inch plastic sewer pipe which can easily be made into grow tubes. There are many advantages to using plastic sewer pipe as follows:

(a) low cost, cheaper than a prefabricated flood table (b) will reduce humidity and moisture in grow rooms (c) easy to assemble (d) holds plants firmly upright (e) can be custom made to fit any size or style room to 90% capacity. (f) plants will be evenly spaced wall to wall with no room to walk, however certain grow tubes are moveable which will create isles to walk and service plants etc



To begin with place saw horses to support the grow tubes, they should be placed every 6ft. As an example if the tubes are 6ft in length, use two saw horses, if the tubes are 12ft in length you will require 3 saw horses and so on. The grow tubes should be raised at one end and lower at the end where the reservoir is to be located. The proper amount of slope for the tubes is 3 inches for every 6ft, if the tubes are 12ft in length you will require the tubes to be 6 inches higher at the far end. The proper slope of grow tubes directs water downhill towards the reservoir, and assists in pressurizing the irrigation system (plumbing).

Grow tubes can be permanently fastened to the saw horses with plumbers strapping. There will be 4 grow tubes every 6 ft, this makes 18 inches of space available to each plant. Use 2 screws to fasten the strapping to the saw horses and 2 more screws through the strapping into the tubes. Certain tubes should be moveable to create isles that you can walk in, every set of 4 tubes per light will have the 2 center tubes fastened permanently to the saw horses while the two outer tubes should be fastened to 10 inch x 10 inch pieces of 3/4 inch plywood. The plywood pieces will rest on the saw horses and slide when moved. This method allows us to fill grow rooms to 90% capacity which is more productive. Once the plants reach full size you won't see any room to walk between the plants, sliding the rows apart creates a walkway to service the room.

plumbers strap



Once the grow tubes are set in place on the saw horses it is time to cut holes for the 6 inch containers to sit in. Cut the holes 18 inches apart on center with a 6 inch hole saw.

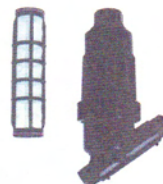


Hole saw

Now that the grow tubes have been set up you will need to install a simple irrigation system. If your room has 50-100 plants select a water pump with a rating of 900 GPH (Gallons per hour). If the room has more than 100 plants use 2 water pumps with the same rating.



The water pump should have a filter to remove small debris such as algae, leaf or Rockwool that could clog the drip tubing leading to the plants. The photo provided is of an inline water filter most often referred to as a barrel filter, these filters can be found at most hydroponic supply stores. Barrel filters are easy to clean, just unscrew the barrel cover to remove the filter and clean with a toothbrush before you re-assemble.



The plumbing leading from your water pump (should be 3/4 inch diameter) will lead to the highest end of the grow tubes, then branch off with 1/2 inch tubing leading to the low end of the grow tubes near the reservoir.

The reason we use 3/4 inch tubing from the pump to the highest end of the grow tubes is because it has the least amount of resistance. The 1/2 inch tubing leading from the 3/4 inch tubing to the reservoir is used because smaller tubing will pressurize better. Be sure to install plugs in the ends of the 1/2 inch tubing.

The 1/2 inch tubing should only be fastened to rows of grow tubes that have been permanently attached to the saw horses. The easiest way to fasten tubing to the grow tubes is to use duct tape.

Many plastic fittings are available from your local hydroponic supplier that will be in the form of "T's", elbows, and plugs. Certain T's can adapt 3/4 inch to 1/2 inch which will meet your needs for different size tubing. The tubing and fittings for the grow room have a barbed design that will press fit to the tubing, glue will not be needed.



Threaded to barbed



T



Elbow

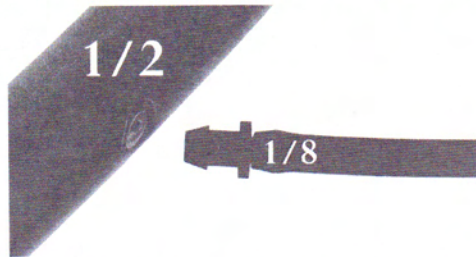


plug

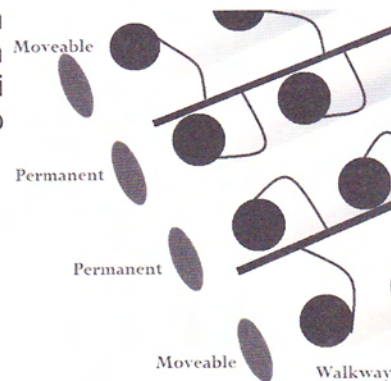
For best results feed the plants for 5 minutes at a time every other hour while the lights are turned on, 6 times per day while in Bud and up to 9 times for Grow.

Once all the 1/2 and 3/4 inch tubing is secured into place you will be required to install small 1/8 inch spaghetti tubing with connectors, these are the small tubes that deliver water to each individual plant. 1 spaghetti tube per plant will do.

The spaghetti tube should measure 18 inches in length. Installation is easy, just puncture the 1/2 inch tubing where you would like to position the spaghetti tube and press fit the barbed fitting until it snaps into place.



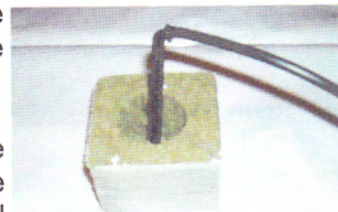
1/2 inch line and 1/8 inch spaghetti tube



Placement of line and tubing

Once all the spaghetti tubing has been snapped into place you should press fit some watering spikes to the end of the tubing.

Watering spikes direct the water downward from the spaghetti tubing into the grow containers. Placement of the spikes is very easy just shove the spike into the Rockwool container.



Watering spike

The 6 inch containers that will be filled with Rockwool are available in 2 types. Thick wall plastic containers have a sturdier base and are better suited for outdoor use when growing in soil.

For our hydroponic system we suggest you purchase the thin wall plastic containers. Thin wall containers have flexible sides and can be made to fit in to the pre-drilled openings.



Thin wall plastic

Before assembling the tubing and irrigation system always place black and white plastic on the walls of the grow room with the white side facing towards the plants. White plastic offers excellent reflection for the lighting used in grow rooms. Never use tin foil as it does not reflect light evenly.





CROP SELECTION

The two most common types of marijuana are Indica and Sativa described as follows:

In the past people used to grow marijuana outdoors, this was before the discovery and invention of specialized lighting that would make indoor growing possible. The most common type of marijuana for outdoor cultivation is Sativa strains.

Sativa strains generally take 9-11 weeks to complete the bud cycle. Sativa strains of marijuana also are taller in stature ranging from 6ft to 10ft in height with a tree like appearance. Because of their size and the amount of time involved to harvest bud these plants are not desirable for indoor cultivation.

Since the beginning of indoor cultivation growers have been genetically engineering strains of Indica plants to produce more bud in a shorter period of time. Indica plants are usually 3-4ft in height, bushy in appearance and take 6 to 8 weeks to complete the bud cycle.

Many seed banks offer strains of marijuana that will perform well indoors as well they can supply types specifically for outdoor production. When selecting a plant for indoor production look for a type that will harvest in 7-8 weeks, with a finishing height of 3-4 ft.

Most indoor varieties available at seed banks will have been proven to grow well with high THC content. We recommend the Northern Lights variety as it has a pleasant but low odor compared to some other types. Also Northern Lights is well known for and incredible amount of THC crystals covering the bud. When Northern Lights is grown with our method the finished product will look amazing. Buds are covered in THC crystals...Just touching the dried bud will form hash on your fingers.

When your grow operation is running at full capacity be cautious before selecting a different variety to grow. It is wise to try a few plants under one light before you commit to changing varieties completely. Once you have confirmed good results then gradually change to the new variety. Some types will produce more bud, but may have a much stronger odor. If odor is not a concern than switch to the better producer.



CROP MANAGEMENT

Typical grow operations consist of one room to grow plants (18hrs light) and two rooms to produce bud (12hrs light). Usually the two bud rooms have a schedule that is offset, this means that when it takes an average of 8 weeks for plants to bud a grower will be able to harvest one of the rooms four weeks before the other bud room is ready to harvest and so on. At best this method will produce 13 crops every 12 months.

Best results require the use of calendars to keep on a set schedule. When growing indoors with CO2 plants can be ready to harvest in 2 weeks growth (18hrs) and 7 weeks bud (12hrs). **We have developed a mathematical equation that will allow growers to harvest plants every three weeks using the configuration of one grow room and two bud rooms explained as follows:**

Our method of producing marijuana involves 2 weeks of growth from clones on an 18hr light cycle. When plants reach 14-16 inches in height they are ready to produce bud 12hr light cycle.

We know that after the 2 weeks of growth are complete it takes another 7 weeks to complete the bud cycle for a total of 9 weeks from beginning to end.

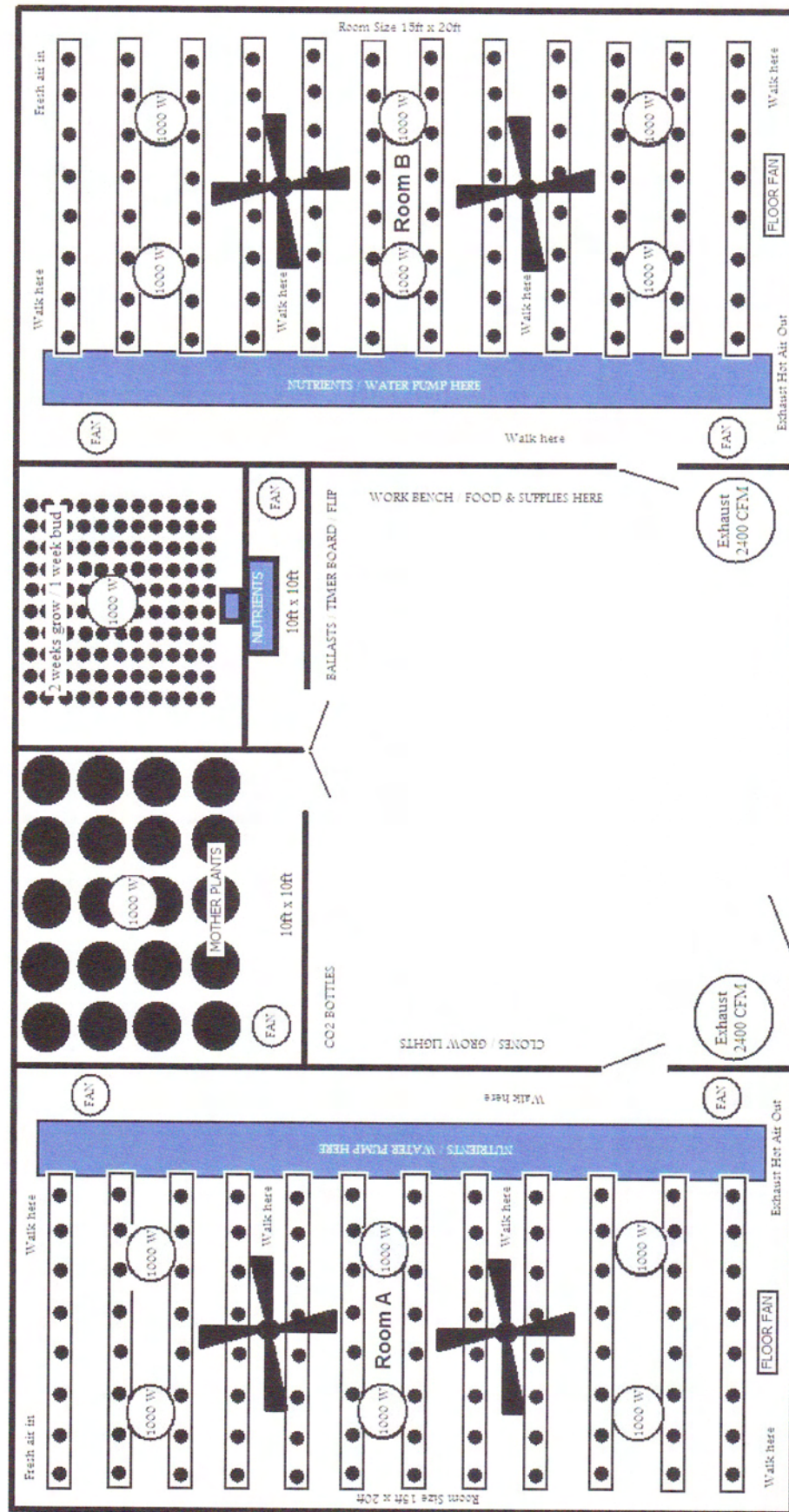
We know that 9 weeks is divisible by the number 3, as a result we have found that using the grow room for 2 weeks of growth (18hrs) and one week of bud (12hrs) completes a third of the time required to harvest a plant from the stage of transplanting.

With 2 weeks growth and 1 week bud completed, we have a remainder of 6 weeks to harvest the plants. Knowing that we have created an offset between bud rooms that will allow growers to harvest bud every three weeks.

We have provided examples of calendars that will keep you on a schedule of harvesting every 3 weeks. There is far too much information to keep track of things on a single calendar which is why we have created one calendar for the grow room and one calendar for the bud rooms.

All tasks have been carefully plotted out on our calendars. The information provided is an example that can easily be transferred to your current calendars.

By following our exact schedule you will be able to harvest bud 17 times per year !



This blueprint is of a grow operation (20ft x 50ft = 1000sq ft) that will produce 12lbs of dried Marijuana Bud every 3 weeks, or an average of 200lbs of dried marijuana every 12 months. Construction of this room as well as maintenance and operation are fully explained in the following pages.

July Grow/Clone Schedule

Example only, transfer to your current calendars

Sun	Mon	Tue	Wed	Thu	Fri	Sat
Make Clones Now				1 Replace Vapor strips	2	3
4	5	6	7	8	9	10
11 Transplant Clones to Flood Table Now (18hrs Light) 1st Day of Grow (18hrs Light)	12	13	14	15	16	17
18 Make Clones Now 2nd Week Grow (18hrs Light)	19	20	21	22	23	24
25 1st Week Bud (12hrs Light)	26	27	28	29	30	31 Move plants to Bud Room A Now.

August Grow/Clone Schedule

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 Transplant Clones to Flood Table Now Replace Vapor strips 1st Day of Grow (18hrs Light)	2	3	4	5	6	7
8 Make Clones Now 2nd Week Grow (18hrs Light)	9	10	11	12	13	14
15 1st Week Bud (12hrsLight)	16	17	18	19	20	21 Move plants to Bud Room B Now.
22 Transplant Clones to Flood Table Now 1st Day of Grow (18 hrs Light)	23	24	25	26	27	28
29 Make Clones Now 2nd Week Grow (18hrs Light)	30	31				

September Grow/Clone Schedule

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 Replace Vapor strips	2	3	4
5 1st Week Bud (12hrsLight)	6	7	8	9	10	11 Move plants to Bud Room A Now.
12 Transplant Clones to Flood Table Now 1st Day of Grow (18 hrs Light)	13	14	15	16	17	18
19 Make Clones Now 2nd Week Grow (18hrs Light)	20	21	22	23	24	25
26 1st Week Bud (12hrsLight)	27	28	29	30		Move plants to Bud Room B Now.

August Bud Schedule

Example only, transfer to your current calendars

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 Transfer plants from Veg Room to Bud Room A now. Replace Vapor strips 2nd Week Room A 5th Week Room B	2	3	4	5	6	7 Use Bamboo stakes and tie plants Bud Room A Tie up Heavy branches Room B
8 Water Only Now Bud Room B 3rd Week Room A 6th Week Room B	9	10	11	12	13	14
15 Water Only Now Bud Room B 4th Week Room A 7th Week Room B	16	17	18	19	20	21  Harvest Now Room B
22 Transfer plants from Veg Room to Bud Room B now. 5th Week Room A 2nd Week Room B	23	24	25	26	27	28 Use Bamboo stakes and tie plants Bud Room B Tie up Heavy Branches Room A
29 Water Only Now Bud Room A 6th Week Room A 3rd Week Room B	30	31				

September Bud Schedule

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 Replace Vapor strips	2	3	4
5 Water Only Now Bud Room A 7th Week Room A 4th Week Room B	6 1 hour Pluck large fan leaves Room A	7 1 hour Pluck large fan leaves Room A	8 1 hour Pluck large fan leaves Room A	9 1 hour Pluck large fan leaves Room A	10 1 hour Pluck large fan leaves Room A	11  Harvest Now Room A
12 Transfer plants from Grow Room to Bud Room A now 2nd Week Room A 5th Week Room B	13	14	15	16	17	18 Use Bamboo stakes and tie plants Bud Room A Tie up Heavy Branches Room B
19 Water Only Now Bud Room B 3rd Week Room A 6th Week Room B	20	21	22	23	24	25
26 Water Only Now Bud Room B 4th Week Room A 7th Week Room B	27 1 hour Pluck large fan leaves Room B	28 1 hour Pluck large fan leaves Room B	29 1 hour Pluck large fan leaves Room B	30 1 hour Pluck large fan leaves Room B		

October Bud Schedule

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 1 hour Pluck large fan leaves Room B Replace Vapor strips	2  Harvest Now Room B
3 Transfer Plants from Grow room to Bud Room B now. 5th Week Room A 2nd Week Room B	4	5	6	7	8	9 Use Bamboo stakes and tie plants Bud Room B Tie up Heavy Branches Room A
10 Water Only Now Bud Room A 6th Week Room A 3rd Week Room B	11	12	13	14	15	16
17 Water Only Now Bud Room A 7th Week Room A 4th Week Room B	18	19	20	21	22	23  Harvest Now Room A
24 Transfer plants from Veg Room to Bud Room A now. 2nd Week Room A 5th Week Room B	25	26	27	28	29	30 Use Bamboo stakes and tie plants Bud Room A Tie up Heavy Branches Room B
31 Water Only Now Bud Room B 3rd Week Room A 6th Week Room B						



TRIMMING

If you wait until the last minute trimming can be a very time consuming job and difficult for a person to manage on their own. If you follow these simple directions trimming a large quantity of plants can be relatively easy for one person.

One week before the scheduled harvest date spend about an hour or two each day plucking off the biggest leaves. You should notice some leaves are already turning yellow / brown and dying off, start plucking those leaves and finish with the remaining leaves over time. This will make it possible for light to penetrate deeper into the plant reaching buds that are being blocked from the light by leaves. By the time you are ready to harvest all the larger leaves should have been removed making the job of trimming much easier.



When you are chopping down the plants it is a good idea to stand the plants in a bucket of water to prevent the leaves from wilting before you have a chance to trim them. You should be able to fit 16-20 plants in a 5 gallon bucket 1/4 full of water. This is very helpful when you are in a hurry to clean up and reload your bud room, as well as clean and reload the grow room with clones that are waiting. This is usually done on the same day before you begin to trim plants.

If you have high quality marijuana the small leaves that you will be trimming with scissors will have THC crystals all over them, save and dry these small fan leaves to make hash oil with. Once the plants are trimmed hang them until dry.



DRYING

Many people have different ways of drying or curing their marijuana bud before packaging. Our method works very well for mass production. Hang each plant from a string for 2-3 days in temperature 70-80 degrees Fahrenheit.

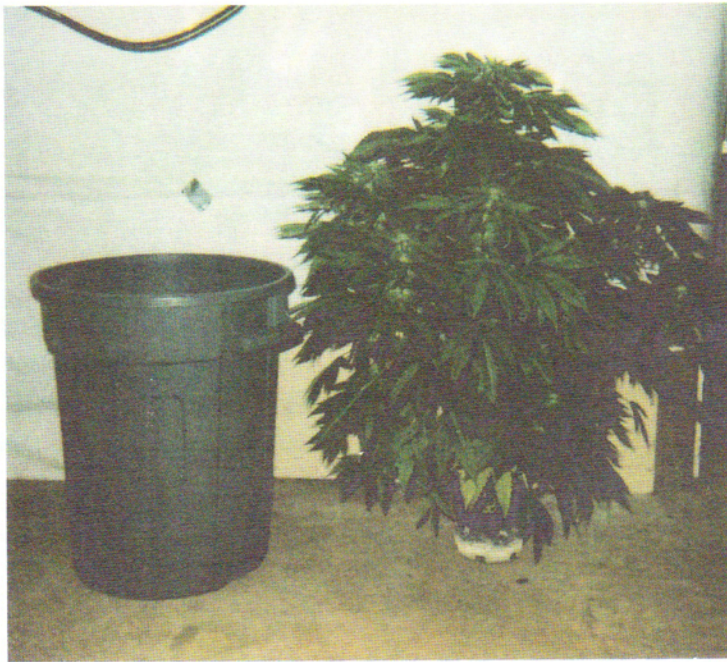
Don't be worried about over drying your bud. The bud can be trimmed from the plants for packaging when you are able to SNAP the stems in half. If the stems are still moist and will only bend and not break then your bud is not dry enough to be trimmed from the branches.

When trimming dry bud from the branches always cut the stems at a 90 degree angle. If you cut the stems at a 45 degrees angle they will be very sharp and poke holes through plastic bags when packaged.

You might notice that the bud is very dry and may be fragile while you are trying to package. There is a way to restore the correct level of moisture to your bud so that it can be packaged without breaking.

Fill a freezer bag (usually measure 11 inches x 11 inches) with 8 ounces of bud. Once full place 2 or 3, 1/4 inch thick slices of potato in with your bud and seal the freezer bag. Let the potato sit in the bag with the bud over night, this allows moisture to travel from the potato to the bud.

The following day remove the potato from the freezer bags and mix the bud thoroughly to prevent buds with moisture from sticking together and becoming moldy. After another 24 hours you will notice all the bud in the freezer bag is at the perfect level of moisture and ready to go.



The above photo is of a plant (beside garbage can) that was grown 2 weeks from clone (18hrs light) and 4 weeks of bud (12hrs light). As you can see the hydroponic food and system we have developed makes plants grow incredibly fast. The above plant was one of 128 plants under 12 - 1000w lights in a 12ft x 30ft room / below.





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08 February 2011

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